A DISSERTATION ON

"COMPARISON OF POST - OPERATIVE ANALGESIC EFFICACY OF RECTUS SHEATH CATHETER VERSUS CONTINUOUS WOUND INFILTRATION FOR LAPAROTOMY SURGERY"

Submitted to

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

In partial fulfilment for the award of the degree of

DOCTOR OF MEDICINE

IN

ANAESTHESIOLOGY

(BRANCH X)

INSTITUTE OF ANAESTHESIOLOGY AND CRITICAL CARE

MADRAS MEDICAL COLLEGE

CHENNAI

MAY – 2019

CERTIFICATE

This is to certify that the dissertation titled **"COMPARISON OF POSTOPERATIVE ANALGESIC EFFICACY OF RECTUS SHEATH CATHETER VERSUS CONTINUOUS WOUND INFILTRATION FOR LAPAROTOMY SURGERY"** submitted by **Dr. S. SAKTHI ABIRAMI** in partial fulfilment for the award of the degree of **DOCTOR OF MEDICINE** in **ANAESTHESIOLOGY** by **THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY,** Chennai is an original work done by her in the **INSTITUTE OF ANAESTHESIOLOGY AND CRITICAL CARE, MADRAS MEDICAL COLLEGE**, Chennai during the academic year 2016 – 2019.

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This is to certify that the dissertation titled **"COMPARISON OF POSTOPERATIVE ANALGESIC EFFICACY OF RECTUS SHEATH CATHETER VERSUS CONTINUOUS WOUND INFILTRATION FOR LAPAROTOMY SURGERY"** submitted by **DR. S. SAKTHI ABIRAMI** in partial fulfilment for the award of degree of **DOCTOR OF MEDICINE in ANAESTHESIOLOGY** by **THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY**, Chennai is a bonafide work done by her in the **Institute of Anaesthesiology and Critical Care, Madras Medical College**, Chennai under my guidance and supervision during the academic year 2016 – 2019.

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Place:

DECLARATION

I, **Dr. S. SAKTHI ABIRAMI**, solemnly declare that the dissertation titled **"COMPARISON OF POSTOPERATIVE ANALGESIC EFFICACY OF RECTUS SHEATH CATHETER VERSUS CONTINUOUS WOUND INFILTRATION FOR LAPROTOMY SURGERY"** is a bonafide work done by me in the **Institute of Anaesthesiology and Critical Care**, Chennai under the guidance of the Professor **DR. G.R. RAJASHREE MD, DA,** Institute of Anaesthesiology and Critical Care, Madras Medical College, Chennai and submitted to **The TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY**, Chennai, in partial fulfilment for the requirements for the award of the degree of **DOCTOR OF MEDICINE in ANAESTHESIOLOGY**, examinations to be held on May 2019. I have not submitted this dissertation previously to any university for award of degree or diploma.

Dr. S. SAKTHI ABIRAMI

Date:

Place:

ACKNOWLEDGEMENT

I pay my gratitude to The Lord Almighty for blessing me in all my endeavours.

I am extremely thankful to Prof. Dr. JAYANTHI, MD, FRCP, Dean, Madras Medical college and Rajiv Gandhi Govt. General Hospital for permitting me to conduct this study.

I am immensely grateful to our Prof. Dr.Anuradha Swaminathan, M.D. D.A., Institute of Anaesthesiology and Critical Care, Madras Medical College for her concern and support in conducting this study.

I am extremely thankful and indebted to my guide Prof. Dr.Rajashree, M.D., D.A., Professor of Anaesthesiology, Institute of Anaesthesiology and Critical Care, Madras Medical College for her concern, inspiration, meticulous guidance, expert advice and constant encouragement in preparing this dissertation.

I am very grateful and express my sincere thanks to the professors Dr.Sugantharaj Anuradha M.D.,D.A., Dr.Latha M.D.,D.A., Dr. Samuel Prabhakaran M.D.,D.A., Dr.Vellingiri M.D. D.A., Dr.Bhavani M.D. D.A., Institute of Anaesthesiology and Critical Care, Madras Medical College for their constant motivation and valuable suggestions.

I express my sincere thanks to all my assistant professors for their guidance and expert advice in carrying out this study.

I am thankful to the Institutional Ethics Committee for their guidance and approval for this study.

I express my sincere thanks to my parents - Mr.Sugendiran & Mrs.Shanthi, my brother – Shiva Ganesan and friends who were behind me with extreme moral support and co-operation

I thank all the patients included in the study and their relatives, for their wholehearted co-operation in spite of their illness.

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INTRODUCTION

Effective analgesia is an integral part of postoperative management in surgical patients. Pain is limiting factor, such that it causes the following effects

- Hemodynamic instablility
- Decreased Functional Residual Capacity and increased work of breathing
- Atlectasis and hypoxemia
- Sepsis
- ARDS
- Poor wound healing and wound gaping
- Opioid consumption and its adverse effects
- Postoperative paralytic ileus
- Poor healing of anastomosis site
- Prolonged hospital stay
- Increased morbidity

The analgesic requirement of patients following laparotomy surgeries could not be met by single method. Multimodal analgesic methods were described, both intravenous and regional techniques. Each method has its own advantages and disadvantages, although all method aims to alleviate pain with minimal side effects. Off late, the use of intravenous opioids has been discouraged because of their potency to cause postoperative respiratory

depression, sedation, postoperative nausea and vomiting. This limits the functional capacity of the patient and hence the wound healing is impaired. It also increases the morbidity of patient and prolongs the hospital stay.

For the above mentioned shortcomings, regional anaesthetic techniques were popularised. Epidural analgesia is the most widely used method of analgesia in intra – and postoperative period with a higher success rate. But in patients who are on anticoagulants or patients with anatomical spine distortion the use of epidural catheter to provide continuous analgesia is either impossible or contraindicated. Hence anaesthesia is provided by regional blocks of nerves innervating the incision site in abdominal surgeries.

Modified Rectus Sheath Block is in practice since 19th century. With the advent of portable UltraSonogram machine this regional anaesthetic technique has been revolutionised. The USG provides image to localise the nerve bundles precisely, and thus avoiding the complication of like intravascular injection, local anaesthetic toxicity, damage to nerve bundles and also increases the success rate of blockade. USG guided rectus sheath block can be a single shot injection of local anaesthetic into posterior rectus sheath but the duration of analgesia is limited. Hence a modified rectus sheath block with catheter placement in the posterior rectus sheath allows continuous infusion of local anaesthetic in the post operative period.

AIMS AND OBJECTIVES

- To compare the post-operative analgesic efficacy of continuous rectus sheath catheter infiltration and continuous wound catheter infiltration
- To evaluate the severity of pain using visual analogue scale
- To evaluate the post-operative opioid requirement
- To assess post-operative hemodynamics
- Complication rate

PHYSIOLOGY OF PAIN

- Pain is a complex phenomenon includes sensory and motivational components.
- The sensory component depends on spino thalamic tracts to cerebral cortex
- The motivational component include attention, somatic reflexes, autonomic reflexes and emotional change
- Nociception has 4 components
    1. Transduction
    2. Transmission
    3. Modulation
    4. Perception

NOCICEPTORS (PAIN RECEPTORS)

Primary afferents responds to noxious stimuli in skin, joints, muscles, vasculature and viscera. It responds to multiple energy source that might produce potential injury (mechanical, thermal and chemical stimuli) and relay the information to CNS.

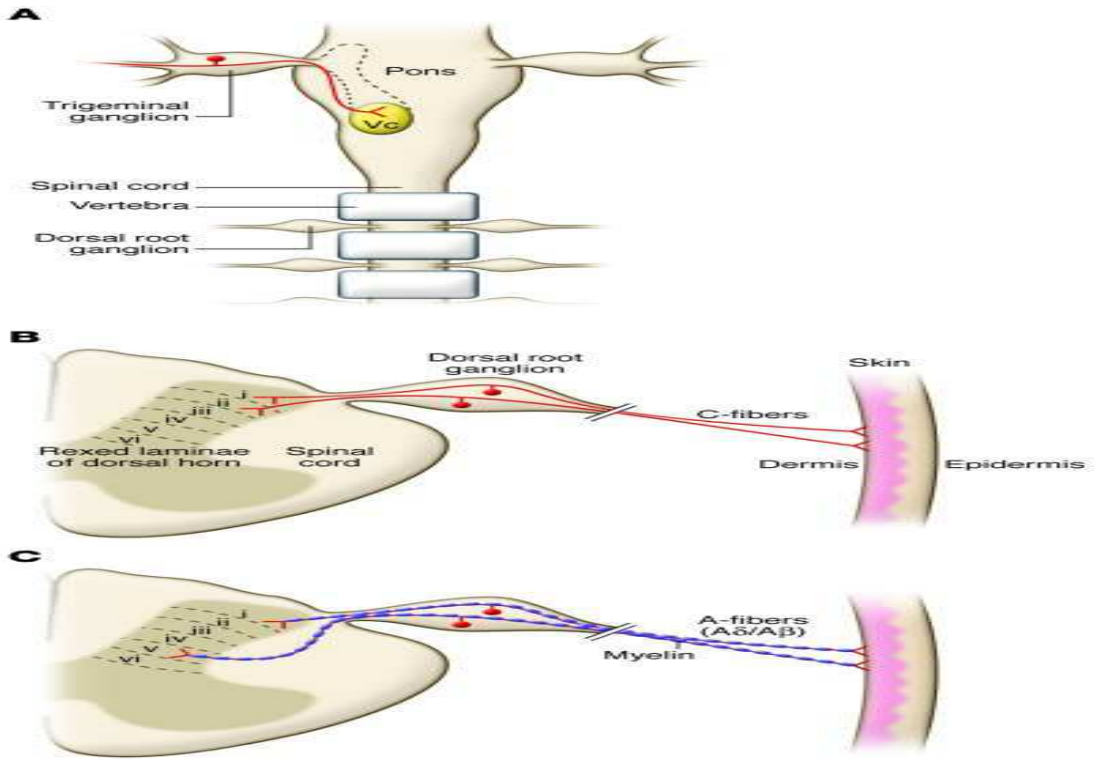
C- fibre afferents – unmyelinated, conduction velocity <2m/sec.

Signals burning pain from intense heat stimuli and sustained pressure

A- Fibre afferents – myelinated, conduction velocity >2m/sec.

Type I – A beta - high threshold mechano receptors

Type II – A delta - heat stimuli, no response to mechanical stimuli



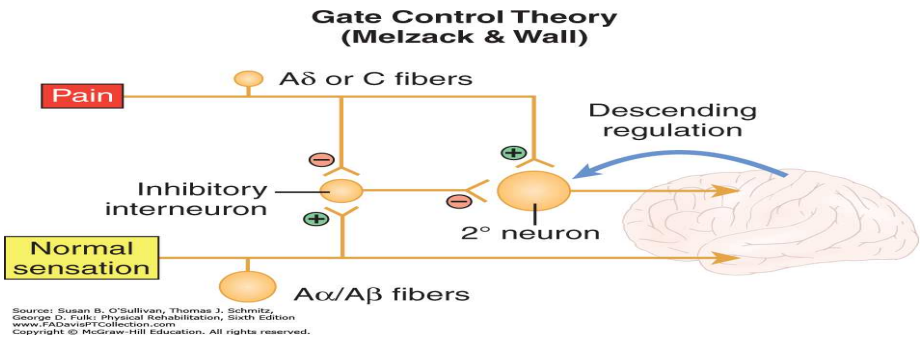
DORSAL HORN: THE RELAY CENTER FOR NOCICEPTION

Afferent fibres from nociceptors enter spinal cord in dorsal root and synapse with dorsal horn neurons. The descending axons from cerebral cortex plays key role in modulating the integration of information. It has six laminae. Laminae I and Laminae II (substantiagelatinosa) are regions where afferent C fibres relay as second order neurons. The site for Widedynamic range (WDR) neurons is Laminae V which encodes the intensity of stimuli. Myelinated A beta and A delta fibres terminate in Laminae I, IV and VII. Unmyelinated fibres from muscles and viscera terminate in Laminae I, II and V. Interneurons are of two functional types:

1. Inhibitory cells – GABA and Glycine
2. Excitatory cells - Glutamate

GATE CONROL THEORY OF PAIN

Proposed by Ronald Melzack and Patrick Wall in 1965. This theory illustrates the neuronal network in pain modulation in dorsal horn of spinal cord. The painful information is relayed to supraspinal regions if the gate is open and if there is simultaneous inhibitory impulses the information will not be felt as the gate is closed. For example, in a bumped elbow, rubbing the skin will activate large myelinated A-beta afferents which are faster the A-delta and non-myelinated C fibres carrying the painful stimuli. The A-beta information will override some of pain stimuli carried by A-delta and C fibres, by activating inhibitory interneurons.



ASCENDING PATHWAY FOR PAIN TRANSMISSION

For integration and perception of nociceptive information, ascending pathwaysfrom spinal cord goes to sites in brainstem and thalamus. The ascending pathways are

1. Spinothalamic tract – projections to thalamus
2. Spinomedullary and spinobulbar tract – projections to homeostatic regions in medulla and brainstem
3. Spinohypothalamic tract – projections to hypothalamus and ventral forebrain.

The Spinothalamic tract carries pain, temperature and itch sensation. It originates in the dorsal horn neuron in lamina I, IV and VIII. About 90% of tract crosses to contralateral side in spinal commisures within one or two segments cranial to the cells of origin. 10% of the tract are found on the ipsilateral side. The lateral STT originates from lamina I and anterior STT originates from laminae V and VII. The axons of STT terminate in several regions of the thalamus.

The spinobulbar tract originates from same neurons as STT in dorsal horn. It crosses over to contralateral side in medulla. It terminates in four areas in brainstem – the brainstem reticular formation, periaqueductal grey mater, catecholamine cell groups (A1 – A7), the parabrachial nucleus. It is important for nociceptive activity that subserve homeostasis and behaviour.

The spinohypothalamic tract has connections with diencephalon, decussate in optic chiasm and descend to hypothalamus and brainstem. It modulates autonomic, neuroendocrine and emotional aspects of pain.

SUPRASPINAL MODULATION OF NOCICEPTION

The commonly activated areas during acute pain are

1. Somatosensory area I & II
2. Anterior cingulate cortex ACC
3. Insular cortex
4. Prefrontal cortex
5. Thalamus
6. Cerebellum

These areas form the emotional aspects of pain and central modulation of pain perception. The S I & S II receive signals from somatosensory thalamus. ACC receives input from medial thalamic nuclei. The insular cortex receives input from thalamocortical tract. The prefrontal cortex receives input from ACC. The thalamus receives input from dorsal horn and the cerebellum.

S I & S II are important for perception of sensory features of pain (e.g. location and intensity of pain). The limbic and paralimbic regions (ACC and IC)are important for motivational and emotional aspects of pain. Anesthetized humans, without conscious pain awareness, exhibit pain- evoked activity suggests the cerebellar activity is more important in regulation of afferent nociceptive activity, than the perception of pain itself.

DESCENDING PATHWAYS OF PAIN MODULATION

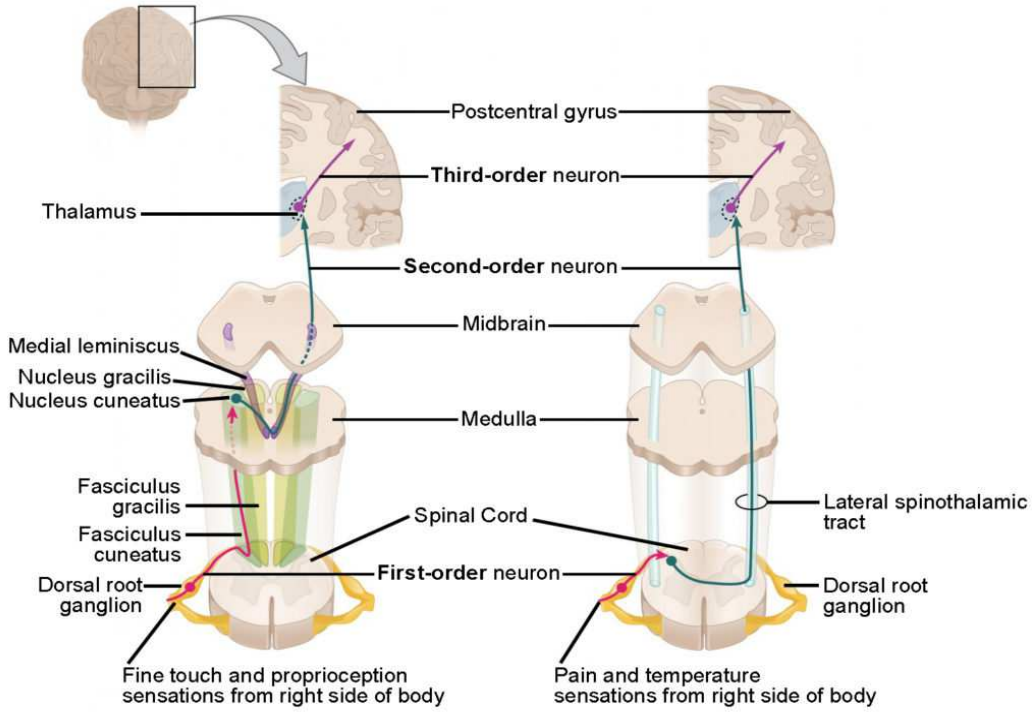
Central mechanisms exist to impede or enhance the passage of nociceptive messages. Supraspinal regions may concurrently promote or suppress nociceptive transmission through dorsal horn neurons, called as descending inhibition pathway and descending facilitation pathway. There is no anatomical separation between this pathway, but it acts through different receptors and neurotransmitters. Electrical stimulation of PAG inhibits the activity of dorsal horn neurons and induces analgesia. The PAG –RVM system contributes to hyperalgesia and allodynia in neuropathic and inflammatory pain. The major source of noradrenergic projections to dorsal horn neurons is locuscereleus and A 5, A 7 noradrenergic cell groups. Electrical stimulation of these cell groups leads too behavioural analgesia. The PAG – RVM is the major brain site for opioid induced analgesia. In RVM, Mu – receptors are located on the ‘on’ cells and Kappa – receptors are located on the ‘off’ cells. Morphine produces post synaptic hyperpolarization by increasing the K+ conductance. It presynaptically inhibits GABAergic synaptic transmission. Activation of kappa – receptors causes bidirectional pain modulation.

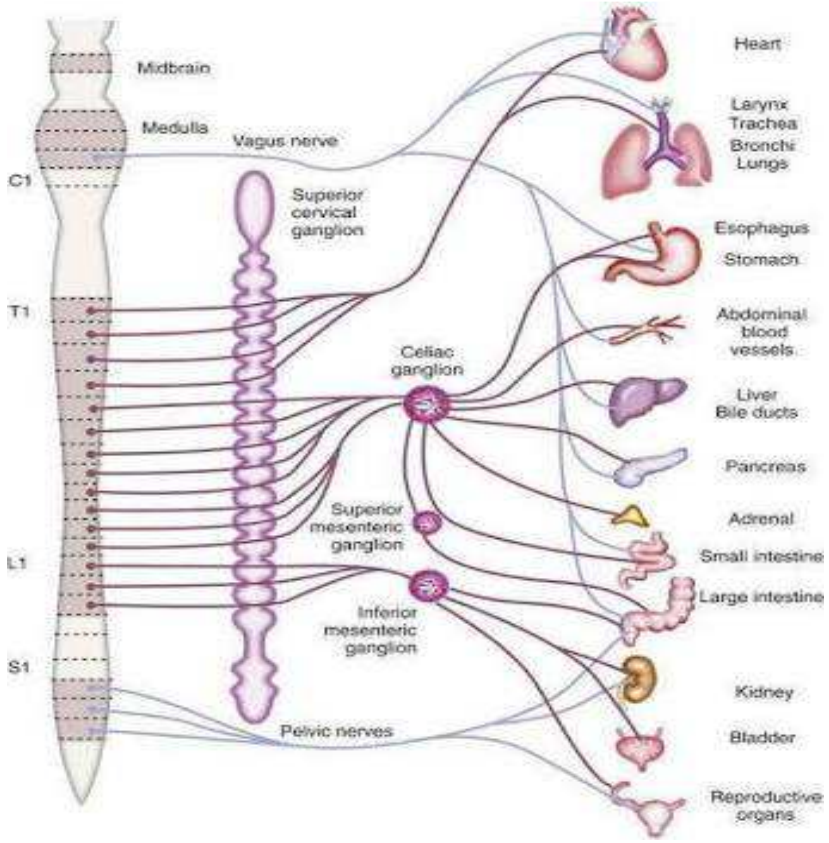
VISCERAL PAIN

Visceral pain is poorly localised and are referred to somatic sites (e.g. skin and muscle) and associated with emotional and autonomic

reaction. These features are attributable to dual nerve endings and structure of visceral receptive endings. Each visceral organ receives two sets of nerve innervation, vagal and spinal nerves or pelvic and spinal nerves. The visceral innervation is also sparse compared to somatic innervation.

The visceral afferents are A delta and C fibres with unencapsulated free nerve endings. A beta fibres are seen in Pacinian corpuscles in the mesentry. Mechanosensitive nerve endings in the intraganglionic laminar endings (IGLEs) and intramuscular arrays that innervate the stomach. The sensory neurons contain substance P and CGRP. They express nerve growth factor receptor TrkA. The axons have their cell bodies in spinal dorsal horn and synapse in laminae I, II, V & X. The information is carried by contralateral STT to supraspinal brain sites. It also receive convergent input from other adjacent visceral structures and somatic structure, which is the basis of ‘Referred pain’. The vagus nerve has cell bodies in nodose ganglion and nucleus tractussolitorius (NTS). The vagal innervation plays important role in autonomic and emotional reactions in visceral diseases. Activation of visceral pain receptors is induced by ischemia, spasm of smooth muscles, stretching of ligaments or distension of hollow structure.


Postcentral gyrus
Third-order neuron
Thalamus
Second-order neuron
Midbrain
Medial leminiscus
Nucleus gracilis
Nucleus cuneatus
Medulla
Fasciculus gracilis
Fasciculus cuneatus
Spinal Cord
Lateral spinothalamic tract
Dorsal root ganglion
First-order neuron
Dorsal root ganglion
Fine touch and proprioception sensations from right side of body
Pain and temperature sensations from right side of body
Dorsal column system
Spinothalamic tract


Midbrain
Medulla
Vagus nerve
C1
Superior cervical ganglion
T1
Celiac ganglion
Superior mesenteric ganglion
L1
Inferior mesenteric ganglion
S1
Pelvic nerves
Heart
Larynx
Trachea
Bronchi
Lungs
Esophagus
Stomach
Abdominal blood vessels
Liver
Bile ducts
Pancreas
Adrenal
Small intestine
Large intestine
Kidney
Bladder
Reproductive organs

ASSESSMENT OF PAIN

Pain must be assessed with a multidimensional approach. The following methods are used to assess the severity of pain

- Chronicity
- Severity
- Quality
- Contributing/ associated factors
- Location/ distribution or etiology of pain, if identifiable
- Mechanism of injury, if applicable
- Barriers to pain assessment

PAIN SCALES

The presently available pain measure fall into two categories

1. Single dimensional scales
2. Multidimensional scales

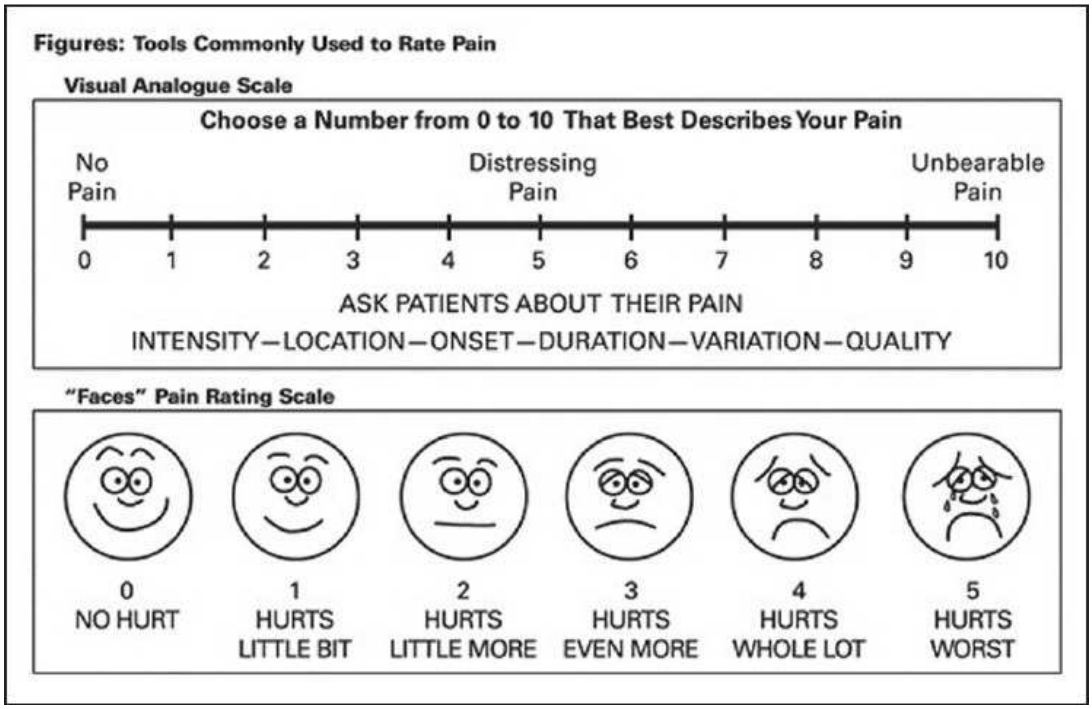
   The results obtained from these instruments must be viewed as guides and not absolutes.

SINGLE DIMENSIONAL SCALES

Single dimensional scales are a simple way for patients to rate the intensity of their pain. These scales assess a single dimension of pain and measure only pain intensity. Patients report on the intensity of their pain through self report. These scales are useful in acute pain when the etiology is

clear, such as trauma, pancreatitis and otitis media. However, they can oversimplify the pain experience. The scales use either numeric, verbal or visual description to quantify pain or to quantify the degree of relief of pain.

Visual scales use picture of anatomy to describe the location of pain. The Wong-Baker Faces Pain Rating Scale can be used with children, adult, patients with mild to moderate cognitive impairment and patients with language issues. This scale presents pictures of 6 – 8 different facial expression that show a range of emotion, as shown in the image below



FACES PAIN RATING SCALE

Verbal scales use common words (e.g low, mild, severe) to describe the intensity of pain. The Melzack and Torgerson scale uses five descriptors: mild, discomforting, distressing, horrible and excruciating.

A verbal numeric pain rating scale is commonly used, in which patients rate their own pain using a scale of 0 – 10. Advantages of numeric scale are their simplicity, reproducibility and sensitivity to small changes in pain. In children, this scale may be used.

MULTIDIMENSIONAL SCALES

Multidimensional scales measure the intensity, the nature and location of the pain, and in some cases, the impact of the pain is having on activity or mood. These are useful in complex or persistent acute or chronic pain when intensity needs to be assessed as well as social support, interference with activities of daily living, and depression.

The McGill Pain Questionnaireassess pain in three dimensions: sensory, affective and evaluative. The three major dimensions are subdivided into 20 subclasses that represent varying degrees of pain. This scale takes 5 – 15 minutes to complete.

The Brief Pain Inventory quantifies both pain intensity and associated disablility, addressing the patient's functional status. It is used for patients with cancer, human immunodeficiency virus and arthritis. It takes 5 – 15 minutes to complete and uses 11 numeric scales to address pain intensity, mood, ability towork, relationships, sleep, enjoyment of life and the effect of pain on general activity. The Brief Pain Inventory can measure the progress of a patient with a progressive disease and can show improvement or decline in the patient's

mood and activity level. Evaluating the function is important in overall pain management.

The Memorial Pain Assessment Card is rapid multidimensional pain assessment tool for patients with cancer. It consists of three separate visual analog scales and assesses pain, pain relief and mood. The card includes a set of adjectives to describe pain intensity and takes very little time to administer.

PAIN ASSESSMENT IN ELDERLY

Acute pain and chronic pain are both very common in elderly. Pain management in this population is important because it allows for effective mobilisation and functional independence. It also may result in decreased morbidity and health care expenditures.

The multiple medical comorbidities and impaired functional status that may be present in elderly patients present significant challenges in the treatment of pain. The number of medications and ratings of depression may contribute to the amount of pain experienced, and the medications used to control pain can have intolerable side effects in the elderly.

Although treating pain in this population is challenging, the assessment and reporting of pain is the most problematic area in this population. One contributing factor is possible underreporting of discomfort because the patient does not want to complain. Other patients may use pain to mask other newly developing physical or cognitive disabilities.

Pain assessment may also be complicated by decrease in hearing and visual acuity, so tools that require extensive explanation or visualization to perform will be more difficult and possibly less reliable. The verbal descriptor scale may be the easiest tool for the elderly to use. This measure allows patients to describe what they are feeling with common words rather than having to convert how they feel to a number, facial representation, or a point somewhere on the straight line.

An important factor in pain assessment in the elderly is assessing the effect the pain is having on their lives, rather than the intensity of the pain itself. Necessary activities of daily living are often maintained despite severe pain. However, the effect pain has on elective activities, such as social functions or advanced activities of daily living may correlate with severity of pain. With cognitive ability, any baseline impairment in activity may also worsen with significant pain.

PAIN ASSESSEMENT IN INFANTS

Infants are dependent on their caregivers to assess their pain and to determine the effectiveness of management efforts because they cannot verbalize their pain sensation. Facial activity, crying and body movements are the most studied behavioural response to pain in neonates. A limited number of facial actions have been studied in infants. The most obvious index is an infant’s cry. However, the interpretation is quite difficult.

Two tools use combination of behavioural and physiological measurement. CRIES (i.e. crying, requires oxygen, increased vital signs, expression, sleeplessness) uses the five variables on a 0 -2 point scale to asses neonatal postoperative pain. The Modified Behavioral Pain Scale uses three factors (facial expression, cry and movements) and has been validated for 2 to 6 month old infants.

PAIN ASSESSMENT IN YOUNG CHILDREN

In children, the caregiver must be aware of the developmental stage of the child to best determine the assessment tool. It is important to interpret behavioural observations cautiously and with cultural sensitivity. Limited cognitive or language skills may influence pain measures, as well as the positive or negative consequences a child's pain reports or behaviours produce. A child sleeping more than usual, for example, may actually ne in significant pain without any crying of whimpering.

In children older than 3 – 4 years, self-report measures may be used. However, children may underreport their pain to avoid future injections of other procedures aimed at alleviating pain.

DRUGS ACTING AT VARIOUS SITES OF PAIN PATHWAY

- PERIPHERAL LEVEL – local anaesthetics, NSAIDS, opioids
- SPINAL CORD – opioids, alpha 2 agonists, local anaesthetics
- CORTICAL LEVEL – opioids.

PHARMACOLOGY OF LOCAL ANAESTHETIC DRUGS

Local anaesthetics are used to produce analgesia and anaesthesia for various surgical and nonsurgical procedures. It provides reversible conduction block of impulses along central and peripheral pathways. With sufficient concentration , the transmission of autonomic, sensory and motor impulses are interrupted leading to autonomic nervous system blockade, sensory anaesthesia and muscle paralysis. Karl Koller introduced Cocaine in 1884, for use in ophthalmology. The first synthetic local anaesthetic was ester derived Procaine. Lidocaine, an amide local anaesthetic, introduced by Lofgren in 1943.

MOLECULAR STRUCTURE

Local anaesthetic consists of lipophilic and hydrophilic portion separated by hydrocarbon chain. The hydrophilic group is a tertiary amine, diethlyamine. The lipophilic portion is an unsaturated aromatic ring, paraaminobenzoic acid. This portion is essential for anaesthetic activity. An ester (-CO-) or an amide (-NHC-) bond links the hydrocarbon chain to aromatic rings. This nature of linkage is the basis for classification of the drugs, site of metabolism and potential to produce allergic reaction.

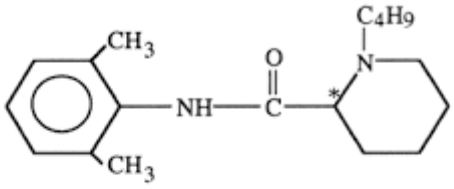
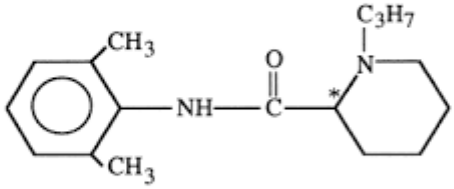
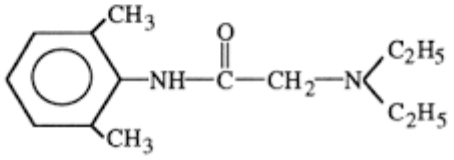
Local anaesthetics are poorly soluble in water. Hence they are marketed as water- soluble hydrochloride salts. It has an acidic pH-6, which gives stability of local anaesthetics. An acidic pH is also important if the solution contains epinephrine, as catecholamine is unstable at an alkaline pH. Sodium

bisulfite is added to commercially prepared solution to make the mixture acidic.

CLASSIFICATION OF LOCAL ANAESTHETICS

ESTERS	AMIDES
Procaine	Lidocaine
Chloroprocaine	Prilocaine
Tetracaine	Mepivacaine
	Bupivacaine
	Levobupivacaine
	Ropivacaine

DRUGS	POTENCY	ONSET OF ACTION	DURATION OF ACTION (MIN)	ELIMINATION HALF – TIME (MIN)
Procaine	1	Slow	45 -60	9
Chloroprocaine	4	Rapid	30 -45	7
Tetracaine	16	Slow	60 -180	
Lidocaine	1	Rapid	60 – 120	96
Prilocaine	1	Slow	60 – 120	96
Mepivacaine	1	Slow	90 – 180	114
Bupivacaine	4	Slow	240 -480	210
Levobupivacaine	4	Slow	240 -480	156
Ropivacaine	4	slow	240 – 480	108

		Molecular Weight	Distribution Coefficient
Bupivacaine		288	346
Ropivacaine		274	115
Lidocaine		234	43

MECHANISM OF ACTION

Local anaesthetics bind to specific sites in voltage gated Na+ channels, block the channels, reduces excitability of neuronal cells and central nervous system. They inhibit the passage of sodium ions through ion selective channels in nerve membranes. It thus slows the rate of depolarization so that threshold potential is not reached and action potential is not propagated. It does not alter the resting membrane potential or threshold potential.

The voltage – gated Na+ channel is a transmembrane protein with alpha – subunit (large sodium – conducting pore) and smaller beta – subunits. The alpha – subunit had 4 subunits – D I, D II, D III, D IV and a H subunit which is located in the inner portion of the channels, to which the local anaesthetics bind. Na+ channel exists in 3 phases during action potential

1. Activated – open state
2. Inactivated – closed state
3. Resting – closed state

Local anaesthetics can gain access to receptors when the channels are in activated – open state. And it binds more strongly to inactivated state. By selectively binding to inactivated – closed states, LA molecules stabilize these channels and prevent their change to rested – closed and activated – open state. This binding is weak and ion channels recover from local anaesthetic induced conduction blockade. The conduction blockade is developed each time Na+ channel opens during action potential (frequency – dependent blockade). A resting nerve is less sensitive to local anaesthetic induced blockade.

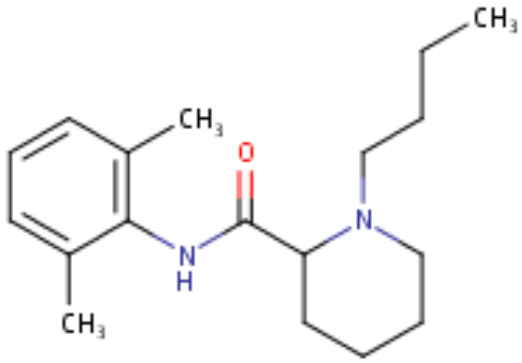
Local anaesthetics also block voltage – gated potassium channels, but its affinity is low. Broadening of action potential by local anaesthetic molecules is due to its action of potassium channels. Calcium ion channels (L – type) may also be blocked by local anaesthetics.

PHARMACOKINETICS

All local anaesthetics are weak bases. At physiological pH <50% of the molecules exists in lipid – soluble nonionized form. Intrinsic vasodilator activity influences potency and duration of action. Vasodilator action of lidocaine results in greater systemic absorption and shorter duration of action. Bupivacaine and etidocaine has similar vasodilator properties. Absorption of local anaesthetic from site of injection depends on dosage, use of epinephrine

and pharmacologic characteristics of the drug. After the drug is injected into site, there is peak in plasma concentration followed by rapid decrease due to high uptake in lungs and distribution to vessel – rich group (brain, heart and kidney). Lipid solubility of drug is important for redistribution into less perfused tissues, fat and skeletal muscle. Protein binding of drug will influence the distribution and excretion. Protein binding parallels the lipid solubility of drug and inversely related to plasma concentration of drug. Ester local anaesthetic are converted into water soluble form, paraaminobenzoic acid, and are readily excreted in urine. As of amide local anaesthetics, elimination is dependent on hepatic metabolism because renal excretion of unchanged drug is minimal.

BUPIVACAINE



CLINICAL USE	CONCENTRATION (%)	ONSET	DURATION (min)	RECOMMENDED MAXIMUM SINGLE DOSE (mg)
Infiltration	0.25	Fast	120 – 480	175
Peripheral nerve block	0.25 – 0.5	Slow	240 – 960	175
Epidural	0.5 – 0.75	Moderate	120 - 300	175
Spinal	0.5 – 0.75	Fast	60 - 240	20

LOCAL ANAESTHETIC TOXICITY

Local anaesthetic systemic toxicity (LAST) is due to excess plasma concentration of drug. Accidental direct intravascular injection during performance of peripheral nerve block or epidural anaesthesia is the most common cause. The factors influencing the severity of LAST are – patient risk factors, medications, location and technique of block, specific LA drug, total dose and adequacy of treatment. The magnitude of systemic absorption depends of

1. Dose
2. Vascularity of injection site
3. Addition of epinephrine to the solution
4. Chemical properties of the drug

Addition of 5mcg of epinephrine to every ml of local anaesthetic (1:2,00,000 dilution) will decrease the systemic absorption by one- third. The drugs vary with regard to CNS and cardiovascular toxicity. For e.g. Bupivacaine is more potent in causing arrhythmia at lower concentration, without causing significant myocardial depression. Lidocaine causes depressed myocardial contractility without arrhythmia.

DOSE DEPENDENT EFFECT OF LIDOCAINE

Plasma conc of lidocaine (mcg/ml)	Effect
1 – 5	Analgesia
5 -10	Circumoral numbness, tinnitus Skeletal muscle twitching Hypotension, myocardial depression
10 -15	Seizures, unconsciousness
15 -25	Apnoea, Coma
>25	Cardiovascular depression

CENTRAL NERVOUS SYSTEM EFFCTS

At low plasma concentration LA produces numbness of tongue and circumoral tissues. At high concentration the drug crosses blood – brain barrier. Restlessness, tinnitus, vertigo followed by slurred speech and skeletal muscle twitching occurs. Twitching is first evident in face and extremities, tonic – clonic seizures occur. Drowsiness occurs before the onset of seizures. Seizures are due to selective depression of inhibitory cortical neurons by drug hence the excitatory pathway becomes unopposed. There is also inhibition of GABAergic transmission in temporal lobe and amygdala. Lidocaine, mepivacaine and prilocaine has effects on CNS at plasma concentration of 5 – 10 mcg/ml. Bupivacaine is associated with seizures at 4.5 – 5.5 mcg/ml concentration. The active metabolite of lidocaine, monoethylglycinexylidide had an additive effect in systemic toxicity. The seizure threshold level increases in

- Decrease in CNS serotonin concentration
- Hypercarbia
- Hyperkalemia

CARDIOVASCULAR SYSTEM EFFECTS

Lidocaine at the concentration of 5 – 10 mcg/ml causes profound hypotension due to decrease in SVR and direct myocardial depression. The cardiac toxicity of LA occurs because of block of cardiac sodium channels. At higher plasma concentration, conduction and automaticity of cardiacmyocytes is depressed resulting in prolonged P-R interval, wide QRS complex in ECG. Accidental IV injection bupivacaine causes hypotension, premature ventricular contractions, ventricular tachycardia, supraventricular tachycardia, atrioventricular heart block. Cardiotoxicity of bupivacaine occurs at plasma concentration 8 – 10 mcg/ml. Drugs which decrease the cardiotoxicity are beta – blockers, digitalis, calcium channel blockers. Toxicity is enhanced by use of epinephrine, phenylephrine, hypoxia, hypercarbia and acidosis. The R enantiomer of bupivacaine is more toxic than s enantiomer. Hence levobupivacaine is not associated with CVS effects.

AMERICAN SOCIETY OF REGIONAL ANAESTHESIA AND PAIN MEDICINE – GUIDELINES FOR MANAGING LAST

A. If signs and symptoms of LAST occur, effective airway management is important in preventing acidosis and hypoxia
B. In case of seizures – treat with benzodiazepines or small doses of propofol/ thiopental are acceptable.
C. Large doses of propofol can depress cardiovascular function. Hence it should be avoided if there is signs of CVS compromise. If seizure persists, succinylcholine / neuromuscular blocker should be considered.
D. If cardiac arrest occurs, ACLS to be followed with following drugs
    - Epinephrine – small initial doses (10 – 100 mcg) is preferred.
    - Vasopressin – not recommended
    - Avoid beta – blockers and calcium channel blockers
    - Amiodarone – for ventricular arrhythmias.
E. Lipid emulsion therapy
    - Initial bolus of 1.5 ml/kg of 20% lipid emulsion
    - 0.25 ml/kg per min infusion, continued atleast 10 min after circulatory stability is established.
    - Approx. 10ml/kg lipid emulsion for 30 min can be given.
F. Propofol is not a substitute for lipid emulsion
G. Cardiopulmonary bypass (CPB) is instituted if it fails respond to lipid emulsion and vasopressor therapy.

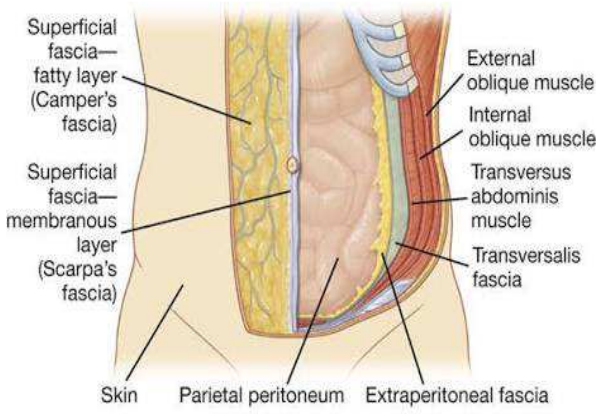
ANATOMY OF ANTERIOR ABDOMINAL WALL

In the anterior median plane, the abdominal wall extends from xiphoid process to the pubic symphysis, which lies at level of coccyx. Posteriorly and laterally, it is replaced by thoracic cage and by gluteal region, on the posterior aspect. The superolateral margins are formed by right and left costal margins – 7^{th}, 8^{th}, 9^{th} and 10^{th} costal cartilage. The costal margin reaches its lowest level in midaxillary line. The anterior abdominal wall is divided in midline by vertical grooves – lineaalba. Below the middle of the median furrow there is an irregular depressed or elevated area called umbilicus. Lateral to the median furrow, the abdominal wall shows curved vertical groove. Its upper end reached the costal margin at the tip of ninth costal cartilage. Inferiorly it reaches pubic tubercle. It corresponds to the lateral margin of rectus abdominis muscle. The 8 layers of anterior abdominal wall are

1. Skin
2. Superficial fatty layer – fascia of Camper
3. Deep membranous layer – fascia of Scarpa
4. External oblique muscle
5. Internal oblique muscle
6. Transversusabdominis muscle
7. Fascia transversalis
8. Peritoneum

SKIN

The skin is capable of undergoing enormous stretching as seen in pregnancy, accumulation of fat. The umbilicus is the normal scar in the anterior abdominal wall formed the remnants of the root of umblical cord. With reference to the lymphatic and venous drainage, the level of umbilicus is watershed. The skin around umbilicus is supplied by T10 segment of the spinal cord.



SUPERFICIAL FASCIA

The superficial fascia is divided into a superficial fatty layer (fascia of Camper) and deep membranous layer (fascia of Scarpa). The fatty layer is continuous with superficial fascia of the adjoining part of the body. In penis, it is devoid of fat and in scrotum it is replaced by dartos muscle. The membranous layer is continuous below with similar membranous layer of perineum known as Colles' fascia. The skin of abdominal wall is supplied by the lower six thoracic nerves and first lumbar nerve. The anterior cutaneous nerves are derived from the lower five intercostal nerves, the subcostal nerve

and the ilihypogastric nerve (L1). T7 – T12 nerves enter the abdominal wall from the intercostal spaces. They pass between internal oblique and transversus muscle, pierce the posterior lamina of internal oblique aponeurosis to enter rectus sheath. They are arranged in serial order, T7 near the xiphoid process, T10 at the level of umbilicus, the iliohypogastric nerve 2.5cm above the superficial inguinal ring. The lateral cutaneous nerves are derived from lower two intercostal nerves T10, T11 and supply the skin of the side of the abdomen and the external oblique muscle. The lateral cutaneous branches of the subcostal and iliohypogastric (T12, L1) supply the skin of anterosuperior part of gluteal region.

EXTERNAL OBLIQUE MUSCLE

The muscle arises by 8 slips from the outer surface of the shaft of lower 8 ribs. The fibres run downwards, forwards and medially. The fibres of the muscle inserts as a broad aponeurosis into xiphoid process, lineaalba, pubic symphysis, pubic crest and pubis. The upper four slips of the origin of muscle interdigitate with serratus anterior and lower four slips with latissimusdorsi. Superficial inguinal ring is formed as aperture just above the pubic crest.

INTERNAL OBLIQUE MUSCLE

The muscle arises from lateral two – thirds of inguinal ligament, anterior two – thirds of iliac crest and the thoracolumbar fascia. It runs upwards, forwards and medially crossing the fibres of external oblique muscle. The upper fibres are inserted into lower 3 or 4 ribs and costal cartilage. The muscle

forms aponeurosis which is inserted into 7^{th},8^{th},9^{th} costal cartilages, xiphoid process, linea alba, pubic crest, and pubis. It does not extend beyond costal margin. The aponeurosis takes part in formation of rectus sheath. The conjoint tendon is partly formed by this muscle. The cremaster muscle is formed by fibres of this muscle.

TRANSVERUS ABDOMINIS MUSCLE

The muscle originates from the lateral one – third of inguinal ligament, anterior two – thirds of inner lip of iliac crest, thoracolumbar fascia, inner surface of lower six costal cartilage. The fibres form broad aponeurosis which inserts into xiphoid process, lineaalba, pubic crest and pubis. The lower part of fibres fuse with fibres of internal oblique to form conjoint tendon. The aponeurosis takes part in forming the rectus sheath. The neurovascular plane of the abdominal wall lies between the internal oblique and transversus muscle. This plane is continuous with neurovascular plane of thoracic wall.

RECTUS ABDOMINIS MUSCLE

The muscle arises by two heads. Lateral head is from the lateral part of pubic crest. Medial head from the anterior pubic ligament. The fibres run vertically upwards. It is inserted in front of wall of the thorax along the line passing laterally from xiphoid process, 7^{th},6^{th} and 5^{th} costal cartilages. This muscle is enclosed in sheath – the rectus sheath.

FASCIA TRANSVERSALIS

The inner surface is lined by fascia which is separated from peritoneum by extra peritoneal connective tissue. The part of fascia that covers the inner surface of transversusabdominis muscle is called fascia transversalis. There is an oval opening in fascia transversalis 1.2cm above the midinguinal point. This is the deep inguinal ring. This ring lies immediately lateral to inferior epigastric artery. It contains the spermatic cord in males and the round ligament of uterus in females.

RECTUS SHEATH

This is an aponeurotic sheath covering the rectus abdominis muscle. It has two walls, anterior and posterior.

1. Anterior wall – it is complete, covering the muscle and the composition is variable
2. Posterior wall – it is incomplete, deficient above the costal margin and below the arcuate line
3. Medial wall – fusion of all the aponeurosis in the midline – linea alba
4. Lateral wall – extends from tip of 9^{th} costal cartilage to pubic tubercle – lineasemilunaris

FORMATION

Above the costal margin

- Anterior wall formed by external oblique aponeurosis
- Posterior wall is deficient. It rests directly over 5^{th},6^{th} and 7^{th} costal cartilage

Between the costal margin and arcuate line

- Anterior wall is formed by external oblique aponeurosis and anterior lamina of internal oblique aponeurosis
- Posterior wall is formed by posterior lamina of internal oblique aponeurosis and transversus muscle

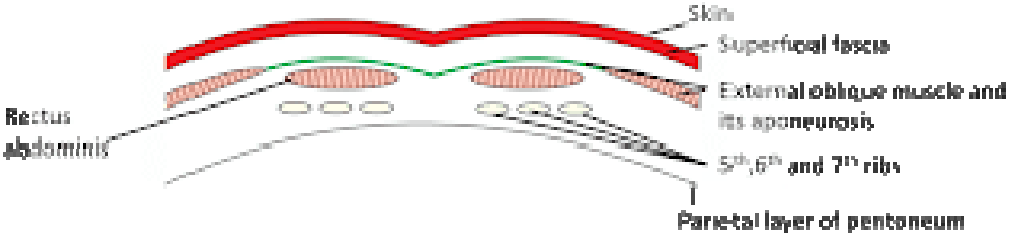
Below the arcuate line

- Anterior wall is formed by aponeurosis of all three muscles of abdomen
- Posterior wall is deficient. It rests on the fascia transversalis

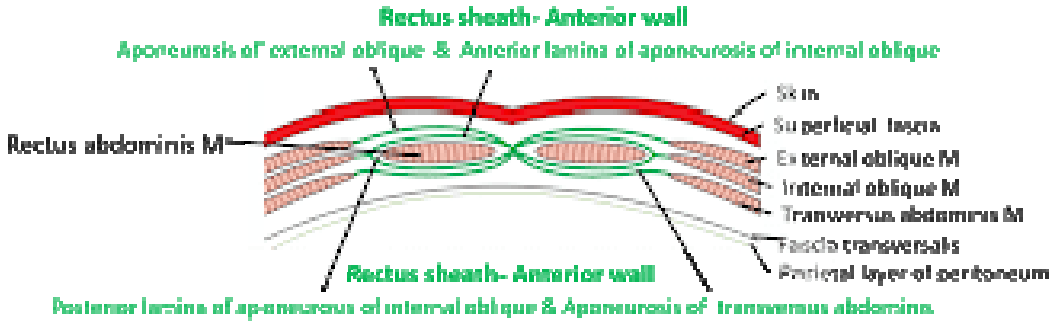
CONTENTS

- Rectus abdominis muscle
- Pyramidalis muscle
- Superior epigastric artery and accompanying vena comitantes
- Inferior epigastric artery and accompanying vena comitantes
- Lower five intercostal nerves
- Subcostal nerves

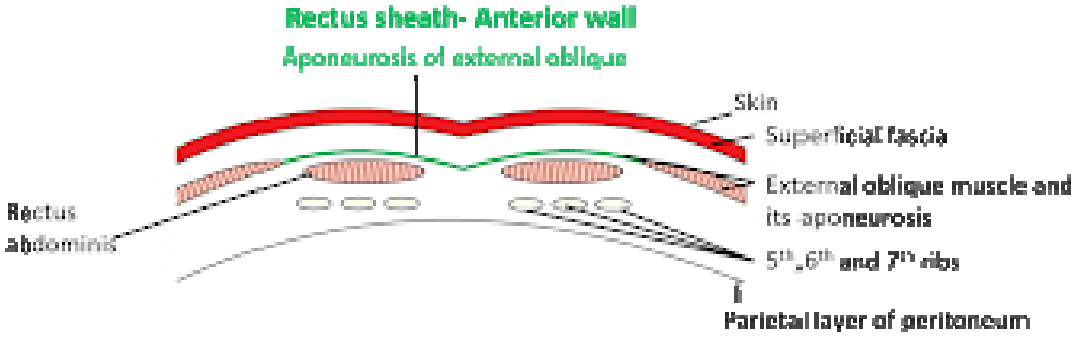
Rectus sheath above the costal margin



Rectus sheath from the costal margin to midway between umbilicus and symphysis pubis



Rectus sheath between the midpoint of umbilicus and pubic symphysis to pubic symphysis



SONOANATOMY OF RECTUS SHEATH

The use of UltraSonogram and its practical technology was first described by Sir Ian Donald shortly after World War II. The widely available commercially available machine makes it application for bedside procedures and faster diagnosis. The USG probe uses piezoelectric effect to emit and receive the sound waves. A simple tool that makes its wide spread clinical use, without the adverse effects of radiation. In regional anaesthesia USG has significant benefits over conventional techniques, in that it allows better view of the anatomical structures, precise placement of needle near the nerve bundles and better success rate of blockade.Diagnostic USG has a higher frequency probe (15 Hz). A high frequency linear probe of 5 – 15 Hz allows better visualization of superficial structures like muscle, tendons, nerves, arteries and veins. A low frequency curvilinear probe 2 – 5 Hz is used for deeper nerves and plexuses.

PRINCIPLES OF USG

The transducers use a polycrystalline ferroelectric materials e.g. lead zirconatetitanate (PZT). It has piezoelectric properties. Under application of an electric current, it expands and contracts depending upon the change in polarity. A series of sound waves is produced. When the sound waves returns, it squeezes the crystal producing a voltage change across its surface, which is amplified and receives the signal. The reflectivity of each tissue depends upon the difference in acoustic impedence of the structures. The reflection form the basis of grey imaging scale, which is presented as matrix of elements.

Reflection of sound waves by different tissue interface

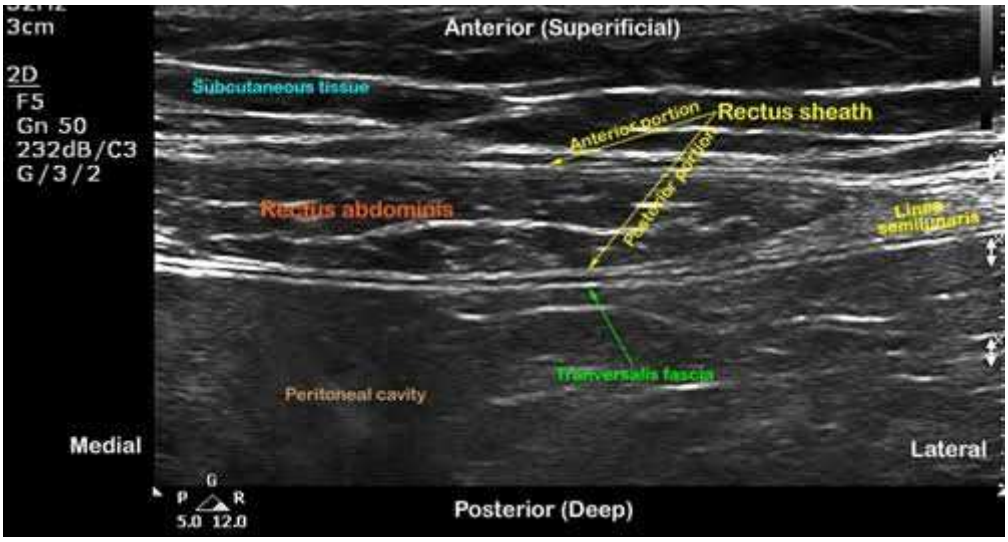
Interface	Reflection coefficient	Percentage of beam reflected
Muscle - fat	0.01	1
Tissue - air	0.99	99
Tissue - bone	0.5	50

The USG appearance of a nerve is dependent on its size and the amount of the surrounding connective tissue. The axons appear black and surrounding tissues like perineurium appears bright (hyperechoic). At different levels the same nerve appearance changes from hypoechoic to hyperechoic. This is because of the change in fascicle nature as the nerve divides and pass through tissue planes. The superficial nerves are easier to visualize. When nerves are accompanied by vessels, it aids in identification. The scanning view is encountered by the USG beam either as short – axis view (SAX) or long – axis view (LAT). The safe procedure is to visualize the needle throughout its entire length.

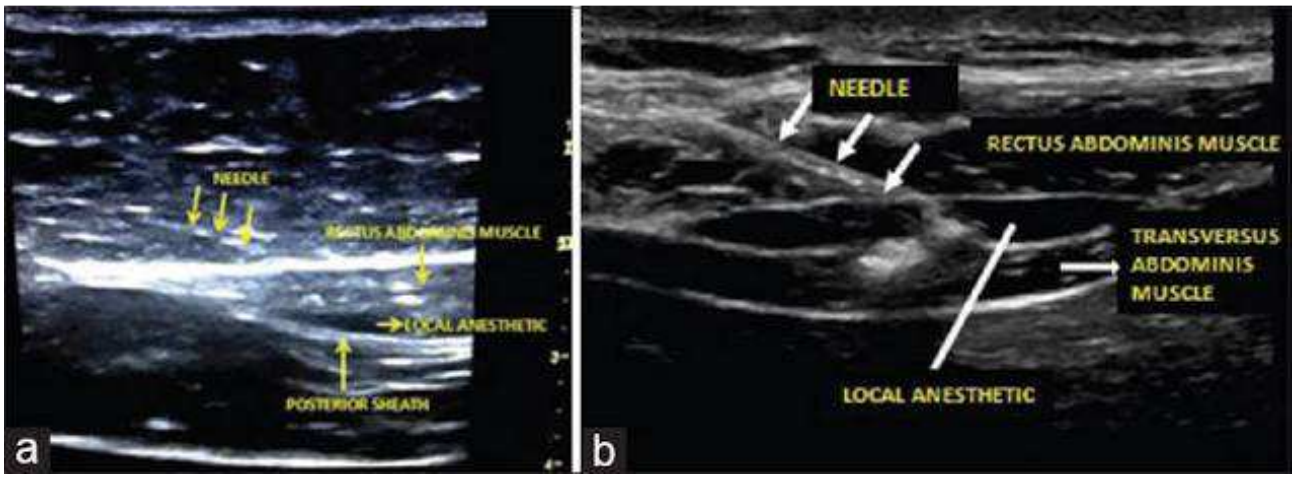
PROCEDURE OF RECTUS SHEATH CATHETER PLACEMENT

The abdomen site is cleaned with alcohol solution, draped. The probe is covered with sterile interface. Air is the worst medium for USG and hence it important to use a adequate layer of gel over the probe – skin interface. The probe is placed over the skin in longitudinal orientation above the umbilicus. Gently move the probe laterally to visualize the target structures – skin,

subcutaneous tissue, external and internal oblique muscle, transversusabdominis muscle as well as the rectus sheath.



Then a 18G Tuohy needle is introduced at an angle of 45 degree to the skin above the costal margin in an in-plane technique. The needle is advanced till it reaches the posterior rectus sheath. A bolus of normal saline was injected to ensure hydrodissection between the muscle and posterior rectus sheath. The hydrodissection is visible on the ultrasound confirming the correct position. The recuts sheath catheter is introduced through the needle into the space, 4 – 8 cm of catheter is left in space. The catheter is tunnelled laterally to avoid interference with the surgical field. The procedure is repeated on the opposite side.


NEEDLE
RECTUS ABDOMINIS MUSCLE
LOCAL ANESTHETIC
POSTERIOR SHEATH
a
NEEDLE
RECTUS ABDOMINIS MUSCLE
TRANSVERSUS ABDOMINIS MUSCLE
LOCAL ANESTHETIC
b


SonoScape
TANTA SURGICAL ICU admin L743
MI 0.8 TIS 0.5
12 /Apr
FPS 98
D/G 160/2
GN 47
I/P 1/30
PWR 70
FRQ 6.6-11
D 3.0cm
Catheter in the space

REVIEW OF LITERATURE

1. Spencer S. Lui, Jeffrey M. Richman, Richard C. Thirlby, Christopher L. Wu – Efficacy of continuous wound catheters delivering local anaesthetic for Postoperative Analgesia: A quantitative and qualitative systematic review of Randomized controlled trials, Journal of American College of surgeons: 2006.

   A qualitative and quantative review of RCT – this study shows that wound catheter offers improved analgesia, increased patient satisfaction and decreased opioid use

2. Dhanapal B, Sistla SC, Badhe AS, Ali SM, Ravishandan NT, Galidevara – Effectiveness of continuous wound infusion of local anaesthetics after abdominal surgeries., Journal of surgical Residence May 15; 212 : 94 - 100

   This study showed that the total morphine consumption in Continuous wound infusion group was significantly lower than the control group. The mean VAS score at rest and cough for postoperative 48 hrs period was less than 4. Respiratory function was assessed using peak expiratory flow rate (PEFR) was better in the continuous wound infusion group and the surgical site infection was similar in both test and control groups

3. Karthikesalingam A, Walsh R Stewart, Markar SR, Malata CM et al – Continuous wound infusion of local anaesthetic agents following colorectal surgeries; World journal of Gasteroenterology:WJG

The local anaesthetic infusion shows a significant decrease in pain VAS on movement till postoperative day 3 (Mean difference: 1.14 with 95% CI 1.91 – 0.029). The total opioid consumption was decreased. There was no significant decrease in length of hospital stay and return of bowel function.

4. Fredman B, Zohar E, Tarabylin A, Shapiro A, Mayo A, Klein E, Jedeikin R – Bupivacaine wound instillation via an electronic patient – controlled analgesia device and a double catheter system does not decrease postoperative pain or opioid requirements after major abdominal surgery; Anaesthesia Analgesia. Jan 2001;92(1):189-93.

   In this randomised controlled, placebo compared study 50 patients were analysed after abdominal surgery through 20 cm incision, bupivacaine 0.25% was instilled over wound by an electronic PCA device. The results showed there was significant reduction in postoperative pain or no reduction in opioid consumption compared with placebo.

5. Polglase AL, McMurrick PJ, Simpson PJ, Wale RJ, Carne PW, Johnson W Continuous wound infusion of local anaesthetic for the control of pain after elective abdominal colorectal surgery; Dis colon Rectum 2007 Dec; 50(12):2158-67.

   A randomised controlled, placebo compared, blinded study of 310 patients in which continuous infusion of ropivacaine compared with saline wound infusion was done after abdominal

colorectal surgery. There was statistical significance for pain at rest, morphine consumption, length of stay or return of bowel function. But there was small statistical significance in pain on movement on postoperative day 1 for the ropivacaine group (mean difference -0.6 with 95% CI -1.08 to –0.13). Hence it was concluded the pain relief is to achieved through multimodal approach

6. Sanderman DJ, Anthony V. Dilley et al – Ultrasound – guided rectus sheath block and catheter placement: ANZ Journal of Surgery 2008;78(7):621-3

   The use of rectus sheath block and catheter placement was described using a portable ultrasound scanner with a 38-mm broadband (6-13 Hz)linear array transducer. Regional anaesthesia was achieved without injury to the target nerves.

7. Willschke H, Bosenberg A, Marhofer P, Johnston S, Kettner C, Wanzel O, Kapral S- Ultrasonography – guided rectus sheath block in paediatric anaesthesia- a new approach to an old technique; British Journal of Anaesthesia 2006 Aug;97(2):244-9.

   This study concluded that bilateral rectus sheath catheter placement under the posterior aspect of rectus sheath under real – time ultrasonographic guidance, infiltration of levobupivacaine 0.25% 0.1ml/kg provides analgesia for umblical hernia repair.

8. J Dolan, P Lucie, T Geary, M Smith, G Kenny – The rectus sheath block for laproscopic surgery in adults: a comparison between the loss of resistance and ultrasound guided techniques

    A comparison of loss of resistance technique with ultrasound guided rectus sheath block using levobupivacaine showed , better accuracy achieved using ultra sound guided rectus sheath block (89.5%) than LOR technique(44.6%). The loss of resistance technique wrongly interprets the fascial plane as anterior layer of rectus sheath.

9. Ferguson S, Thomas V, Lewis I – The rectus sheath block in paediatric anaesthesia: a new indication for an old technique; Paediatric anaesthesia 1996;6(6):436-6.

    A postoperative analgesic rectus sheath block in children undergoing umblical and paraumblical hernia particularly in day – care surgery. A successful block was described in postoperative period upto 24 hours.

10. Auburn F, Mazoit J-X, Riou B. Post operative intravenous morphine titration; British Journal of Anaesthesia 2012;108(2):193-201.

    This study describes protocol for morphine use in postoperative patients, the titration of morphine dose according to mean dose required for adults. It recommends cautious use of morphine in elderly patients, children and in obese patients. The mean dose requirement for patient in PACU was 12mg of four boluses. This

study limits the risk of overdose of morphine and subsequent decrease in ventilatory drive.

11. Auburn F, Monsel S, Lngeron O, Coriat P, Riou B – Postoperative titration of intravenous morphine in elderly patient. Anaesthesiology 2002 Jan;96(1):17-23.

    875 adults and 175 elderly patients were compared for total dose of morphine consumption per kg of body weight and its complications in postoperative period. This study concluded that there was no significant difference in incidence of morphine – related adverse effects between adults and elderly. Hence morphine can be safely administered in elderly patients.

12. Mukeshkumar Shah, Sandeep S Kulkarni, Wendy Fun – The analgesic efficacy of ultrasound-guided modified rectus sheath block compared with wound infiltration in reduction of postoperative morphine consumption in women undergoing open hysterectomy or myomectomy: A randomized controlled trial

    This study showed morphine consumption in intraoperative and postoperative period was not significant in modified rectus sheath block with 0.25% levobupivacaine compared with wound infiltration with 0.5% levobupivacaine. But the “extremely satisfied” than “satisfied” VAS with analgesia was more in Group modified Rectus sheath block than in wound infiltration group

13. Bashandy GMN, Elkholy AHH – Reducing Postoperative Opioid consumption by adding an Ultrasound-Guided Rectus Sheath block to multimodal analgesia for abdominal cancer surgery with Midline incision. Anaesthesiology and Pain medicine 2014;4(3)

    The VAS score was lower in rectus sheath block group compared with General anaesthesia group on postoperative day 0,1& 2. Morphine consumption was lower in rectus sheath block group (95% CI of difference in mean between groups -4.59 to 2.23mg)

14. Rozen WM, Tran TM, Ashton MW, Barrington MJ, Ivanusic JJ, Taylor GI – Refining the course of thoracolumbar nerves: a new understanding of the innervation of anterior abdominal wall. Clin anatomy 2008 May;21(4):325-33.

    The thoracolumbar nerves that innervate the anterior abdominal wall travels as mixed segment of nerves within the transversusabdominis plane (TAP). Rectus abdominis muscle is innervated by T6-L1, a branch from L1 is constant. Damage to nerves in TAP or in rectus sheath is likely to involve all the segmental nerves. Understanding of this anatomy will contribute to clinical outcomes and prevents complications in TAP blocks and Rectus sheath blocks

15. Cornish P, Deacon A. – Rectus sheath catheters for continuous analgesia after upper abdominal surgery. ANZ Journal of Surgery 2007 Jan-Feb;77(1-2):84.

This study shows that a catheter tunnelled into the posterior rectus sheath is used to achieve continuous analgesic block and it is an alternative to epidural analgesia.

16. Shido A, Imamachi N, Doi K, Sakura S, Saito Y – Continuous local anaethetic infusion through ultrasound-guided rectus sheath catheters. Canadian Journal of Anaesthesia 2010 Nov;57(11):1046-47.

This study showed the rectus sheath catheter continuous infusion as an alternative approach to epidural infusion for midline abdominal surgery. The use of epidural analgesia is limited in patients on anticoagulant therapy and undesirable complications like hypotension.

17. Parsons BA. Aning J, Daugherty, McGrath JS. – The use of rectus sheath catheters as an analgesic technique for patient undergoing radical cystectomy. British Journal of Medicine Surgery Urology 2011;4(1):24 – 30

This study concluded that there was no significant difference between the epidural catheter infusion group and bilateral rectus sheath catheter infusion group.

18. Malchow R, Jaeger L, Lam H – Rectus sheath catheters for continuous analgesia after laparotomy – without postoperative opioid use. Pain Medicine 2011 Jul;12(7):1124-2

This study described a multimodal analgesic regimen using bilateral rectus sheath block without opioid use or epidural analgesia following a abdominal surgery with midline incision.

19. AR Godden, MJ Marshall, IR Daniels – Ultrasonography guided rectus sheath catheters versus epidural analgesia for open colorectal cancer surgery in a single centre. The Annals of Royal College of Surgeons England 2013 Nov;95(8): 591-594.

    120 patients were compared for postoperative analgesia with two techniques – Epidural analgesia and Rectus sheath catheter. This showed that Epidural infusion was associated with significant hypotension($p = 0.0001$). But there was no difference in pain score between two groups ($p=0.92$).

20. Dutton TJ, McGrath JS, Daugherty MO. – Use of rectus sheath catheters for pain relief in patients undergoing major pelvic urological surgery. British Journal of Urology 2014 Feb;113(2):246-53.

    This study showed low pain score in both rectus sheath block and rectus sheath catheter group. The duration of hospital stay reduced from 17 days to 10.8 days in both the groups.

21. Bakshi S, Mapari A, Paliwal R – Ultrasound-guided rectus sheath catheters: A feasible and effective, opioid sparing, Post-operative pain management technique: A case series. Indian Journal of Anaesthesia 2105;59(2):118-120.

This study showed 3 case scenarios in which local anaesthetic boluses were given through Rectus sheath catheter provided good pain relief as a part of multimodal analgesia.

22. Padmanabhan J, Rohatgi A, Niaz A, Chojnowska E, Baig K, Woods WGA – Does Rectus Sheath infusion of Bupivacaine reduce postoperative Opioid requirement?. The Annals of Royal College of Surgeon England 2007 Apr;89(3):229 – 232.

    The study showed there was no significant reduction in postoperative opioid requirement or improvement in PEFR with intermittent bupivacaine infusion into the rectus sheath space following a midline laparotomy incision.

23. Tong J. Gan, Pierre Diemunsch, Ashraf S. Habib et al – Consensus Guidelines for the management of Postoperative Nausea and Vomiting. Anaesthesia & Analgesia Jan 2014;118(1):85-113.

    A guidelines for management of Postoperative Nausea and vomiting in patients consuming morphine as a part of multimodal analgesia. This also recommends use of non pharmacological methods for prevention of PONV.

MATERIALS AND METHODS

The study aims to compare two methods of postoperative analgesia i.e. Continuous Wound Catheter infusion versus Rectus Sheath Catheter in patients with abdominal surgery with midline laparotomy incision. This is a Randomised Controlled Trial conducted in Institute of Anaesthesiology and Critical Care, Madras Medical College in General Surgery Operation Theatre, after obtaining clearance from Institutional Ethical Committee.

Study Design **:** Randomised Controlled study

Study Population **:** 60 patients belonging to ASA PS class I & II

Duration of study : October 2017 – December 2017

INCLUSION CRITERIA:

- Age : 30 – 65 YEARS
- ASA : I,II
- Surgery : Elective
- Who have given valid informed consent.

EXCLUSION CRITERIA:

- Not satisfying inclusion criteria.
- Patients posted for emergency surgery
- Patients with difficult airway
- Lack of written informed consent

- Coagulopathies
- Impaired platelet function
- History of seizures and any neurological deficit
- Poor lung compliance such as pulmonary fibrosis
- Allergy to Local anaesthetic drugs
- Patient refusal.
- Patients with severe cardiovascular, respiratory, renal, hepatic diseases.
- Local infection at incision site

MATERIALS

- 18Gvenflon
- Infusion catheter with 18G tuohy needle
- Infusion pump
- Drugs- Inj. Bupivacaine 0.25%, Inj.Glycopyrrolate, Inj. Thiopentone, Inj.Fentanyl, Inj.Neostigmine, Sevoflurane, Emergency drugs, I.V fluids Normal Saline, Ringers lactate.
- Monitors–ECG,NIBP, SPO2, EtCO2, Urine Output.

STUDY OUTCOME MEASURES:

To evaluate the post operative analgesic efficacy of rectus sheath catheter infiltration vs continuous wound infiltration

A. To evaluate post operative severity of pain using visual analogue

scale

B. To evaluate post operative opioid requirements

C.Post operative Hemodynamics.

D. Complication rate

METHODOLOGY

A written informed consent is obtained from all patients. All 60 patients were randomized into 2 groups by closed envelope method. The participants and people analyzing the results were blinded.

Group CWC - Continuous Wound catheter infusion

Group RSC - Rectus Sheath Catheter infusion

PREOPERATIVE:

Clinical examination, Airway examination was done. The following lab investigations done – complete blood count, fasting and postprandial blood sugar, Liver and Renal function tests, Prothrombin time. All patients were categorized based on American Society of Anaesthesiologist Physical Status for Fitness. Patients were given premedication on the morning of surgery.

INTRAOPERATIVE:

Patients were connected to monitor – continuous ECG and NIBP measurements every 5 min, Oxygen saturation, was done in the intraoperative period. Baseline HR, SBP, DBP, MAP and Oxygen Saturation was recorded. Preoxygenation with 100%O2 was done for 5 min. Anaesthesia was induced with Inj. Fentanyl 1 mcg/kg, Inj. Propofol 2 mg/kg followed by Inj. Atracurium 0.5 mg/kg to facilitate endotracheal intubation. Patients lung ventilated and anaesthesia was maintained with Sevoflurane 1 - 2 % and incremental doses of Inj. Atracurium 0.1 mg/kg when needed and adequate surgical relaxation achieved. Intraoperative analgesia was provided by Inj.

Fentanyl 0.5 mcg/kg every 1 hour.

POSTOPERATIVE

After end of surgery according to patients group the postoperative analgesia was provided.

GROUP CWC – Continuous Wound catheter infusion (N = 30)

A multiholed catheter is placed in between the subcutaneous layer and skin on the either side of incision by the surgeon at end of surgery. Upto to 6 – 8 cm is placed inside the layer and secured to skin. Loading dose of 10 ml of 0.25% Bupivacaine is given. The catheters are then connected to infusion pump containing 0.25 % Bupivacaine. Infusion started at rate of 2 ml/hr for each side (total dose 4 ml / hr).

GROUP RSC – Rectus Sheath Catheter infusion (N = 30)

The abdomen site is cleaned with alcohol solution, draped. The probe is covered with sterile interface. Air is the worst medium for USG and hence it important to use a adequate layer of gel over the probe – skin interface. The probe is placed over the skin in longitudinal orientation above the umblicus. Gently move the probe laterally to visualize the target structures – skin, subcutaneous tissue, external and internal oblique muscle, transversusabdominis muscle as well as the rectus sheath. Then 18 G Tuohy needle is introduced at an angle of 45degree to the skin just below the costal margin in an in-plane technique. The needle is advanced till it reaches the posterior rectus sheath. A bolus of normal saline was injected to ensure hydro

dissection between the muscle and posterior rectus sheath. The hydro dissection is visible on the ultrasound confirming the correct position. The rectus sheath catheter is introduced through the needle into the space, 4 – 8 cm of catheter is left in space. The catheter is tunnelled laterally to avoid interference with the surgical field. The procedure is repeated on the opposite side. Analgesia is maintained with 10 ml of Bupivacaine 0.25 % bolus followed by continuous infusion at 2 ml / hr on each side (total 4ml/hr)

EVALUATION

Primary outcome measure – severity of pain is assessed using VAS score (0 – 10) at rest at time 0 hr, 6 hr, 12 hr, 24 hr, 36 hr, 48 hr. If VAS > 4 patient received titrated dose of Inj. Fentanyl 2 mcg/ kg. The dose was stopped if RR < 12/ min and SpO2 < 95%. The postoperative opioid consumption was recoded.

Secondary outcome measure – Heart Rate, Mean Arterial Pressure was recoded at time of 0 hr, 6 hr, 12 hr, 24 hr, 36 hr, 48hr postoperatively.

STATISTICAL ANALYSIS

All data were entered to Microsoft Excel 2010 and later these spreadsheets were used for analysis. Statistical analysis was done using SPSS version 20.0.

- Quantitative data like age, weight, duration of anaesthesia, HR and MAP were analysed using independent t-test for comparison between two groups and expressed as mean ± SD
- The non parametric data like VAS at rest were analyzed using Mann-whitney U test for comparison between two groups
- Sex, number of patients who needed supplemental injection and complications were expressed as number %.
- $P < 0.05$ was considered statistically significant.

OBSERVATION AND RESULTS

TABLE 1 : AGE DISTRIBUTION OF THE STUDY POPULATION

(N=60)

AGE GROUP	CWC GROUP	RSC GROUP	TOTAL
21 – 30	3	3	6
31 – 40	6	9	15
41 -50	12	13	25
51 - 60	9	5	14
TOTAL	30	30	60
MEAN AGE (MEAN ± SD)	44.3 ± 8.5	39.57 ± 6.7	
p value	0.08		

COMMENTS

The age distribution in Continuous wound catheter group was not significantly different from the Rectus sheath Catheter group and hence both groups were comparable.

FIG 1: AGE DISTRIBUTION OF THE STUDY POPULATION (N = 60)

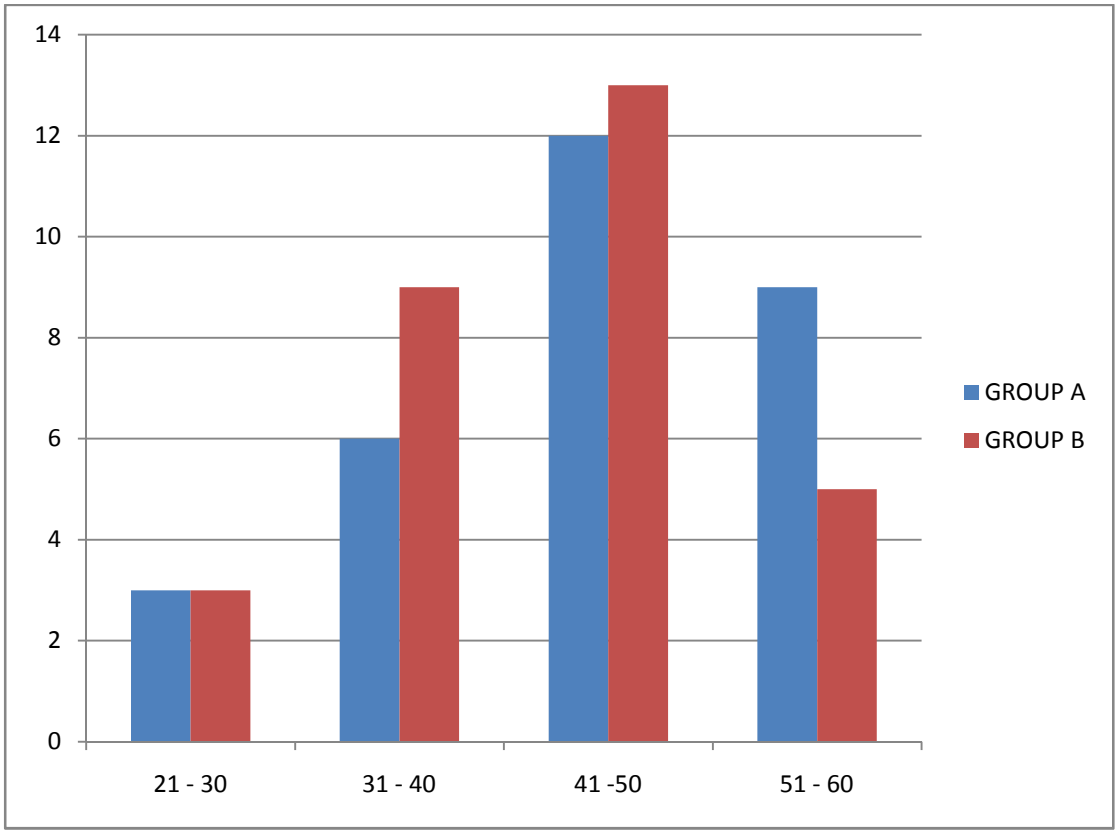


TABLE 2: GENDER DISTRIBUTION OF STUDY POPULATION

(N = 60)

GENDER N (%)	CWC GROUP N (%)	RSC GROUP N (%)	TOTAL N (%)
Male	14 (46.7)	15 (50)	29
Female	16 (53.3)	15 (50)	31
Total	30 (100)	30 (100)	60 (100)

p value : 0.5

COMMENTS

Males and females were equally distributed in wound catheter group and rectus sheath catheter group

FIG 2: GENDER DISTRIBUTION OF THE STUDY POPULATION

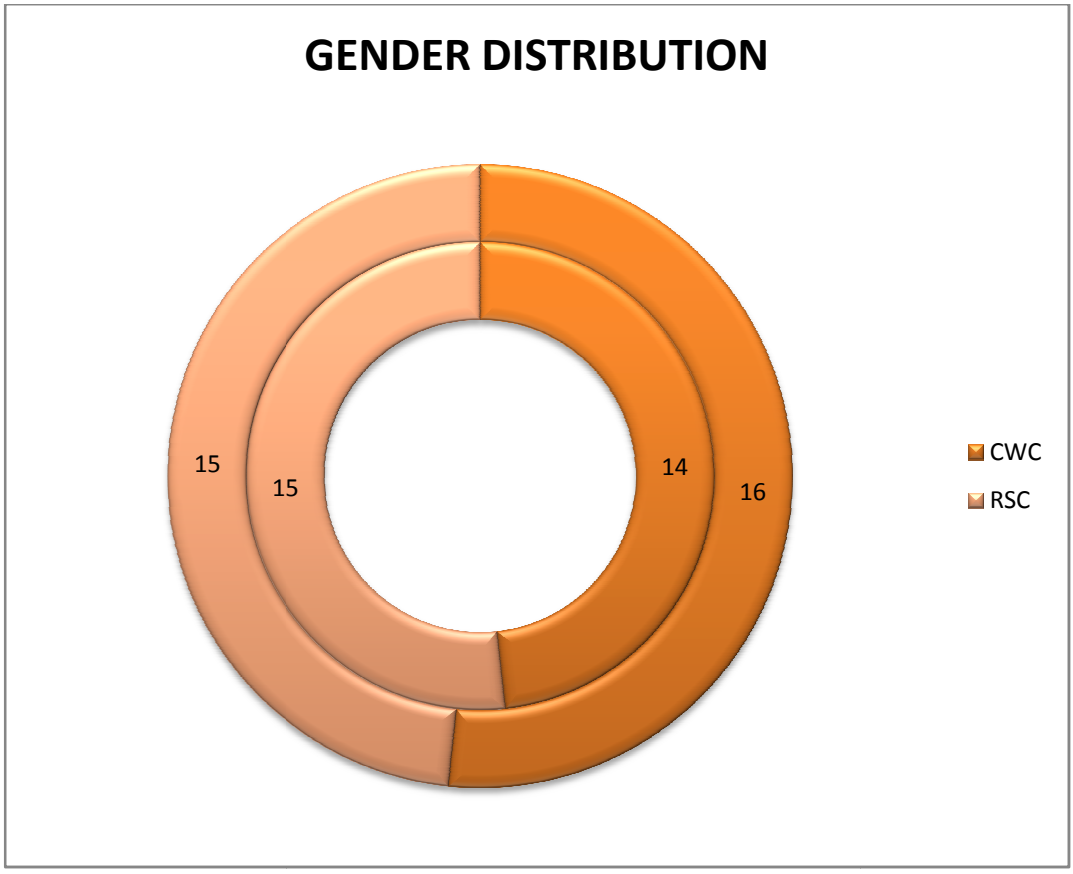


TABLE 3: COMPARISON OF WEIGHT AMONG SUBJECTS IN TWO GROUPS (N = 60)

GROUP	MEAN WEIGHT	STD. DEVIATION	p value
CWC	63.63	7.34	0.477
RSC	64.90	6.321	

COMMENTS

The mean weight of Continuous Wound Catheter group and Rectus Sheath Catheter group was comparable and minor difference between the groups was not statistically significant.

FIG 3 COMPARISON OF WEIGHT AMONG SUBJECTS IN WOUND CATHETER GROUP AND RECTUS SHEATH CATHETER GROUP

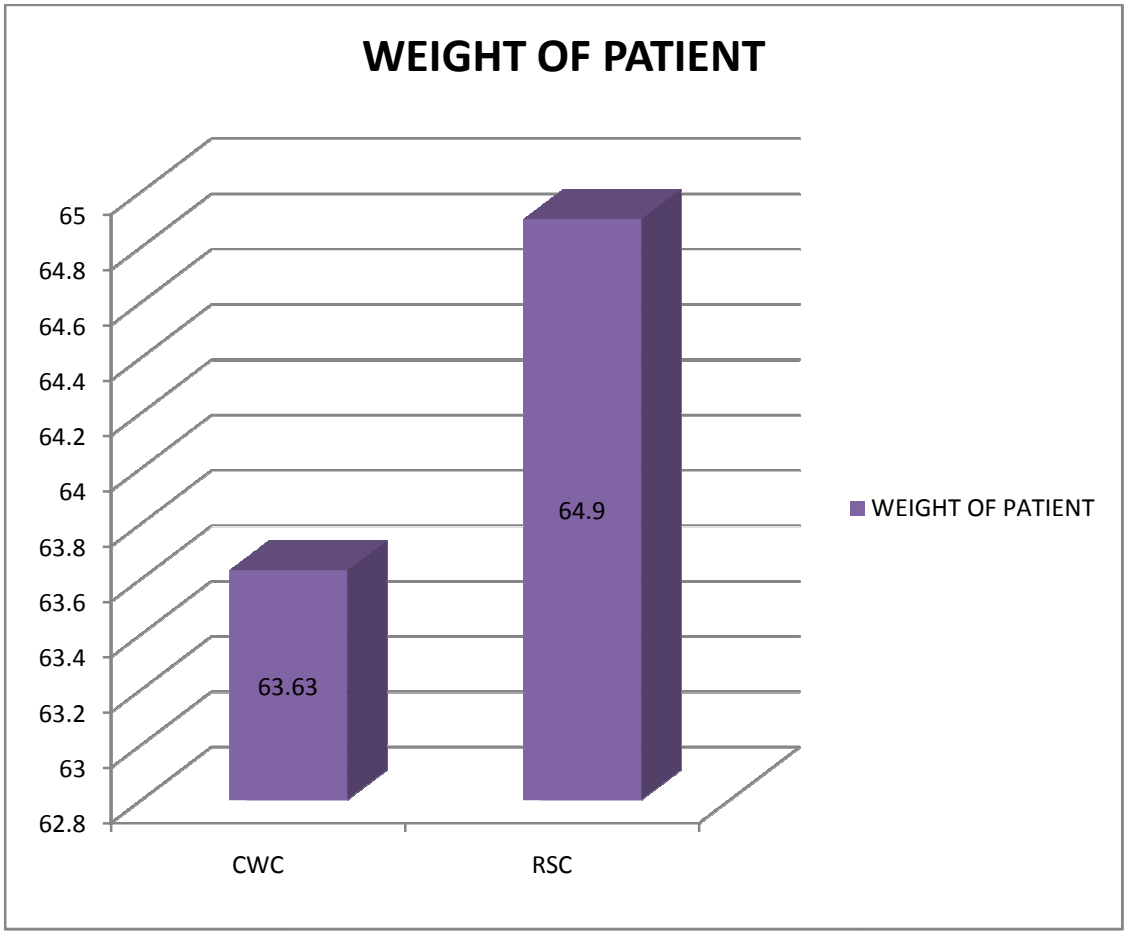


TABLE 4: COMPARISON OF DURATION OF SURGERY AMONG THE TWO GROUPS (N = 60)

GROUP	CWC		RSC	
DURATION OF SURGERY (hours)	MEAN	STD. DEVIATION	MEAN	STD. DEVIATION
	2.5	0.57	2.46	0.58
p value	0.809			

COMMENTS:

The mean duration of surgery between the continuous wound catheter group and rectus sheath catheter group was comparable and the minor difference between the groups was not statistically significant.

FIG 4: COMPARISON OF DURATION OF SURGERY AMONG THE SUBJECTS IN CONTINUOUS WOUND CATHETER GROUP AND RECTUS SHEATH CATHETER GROUP

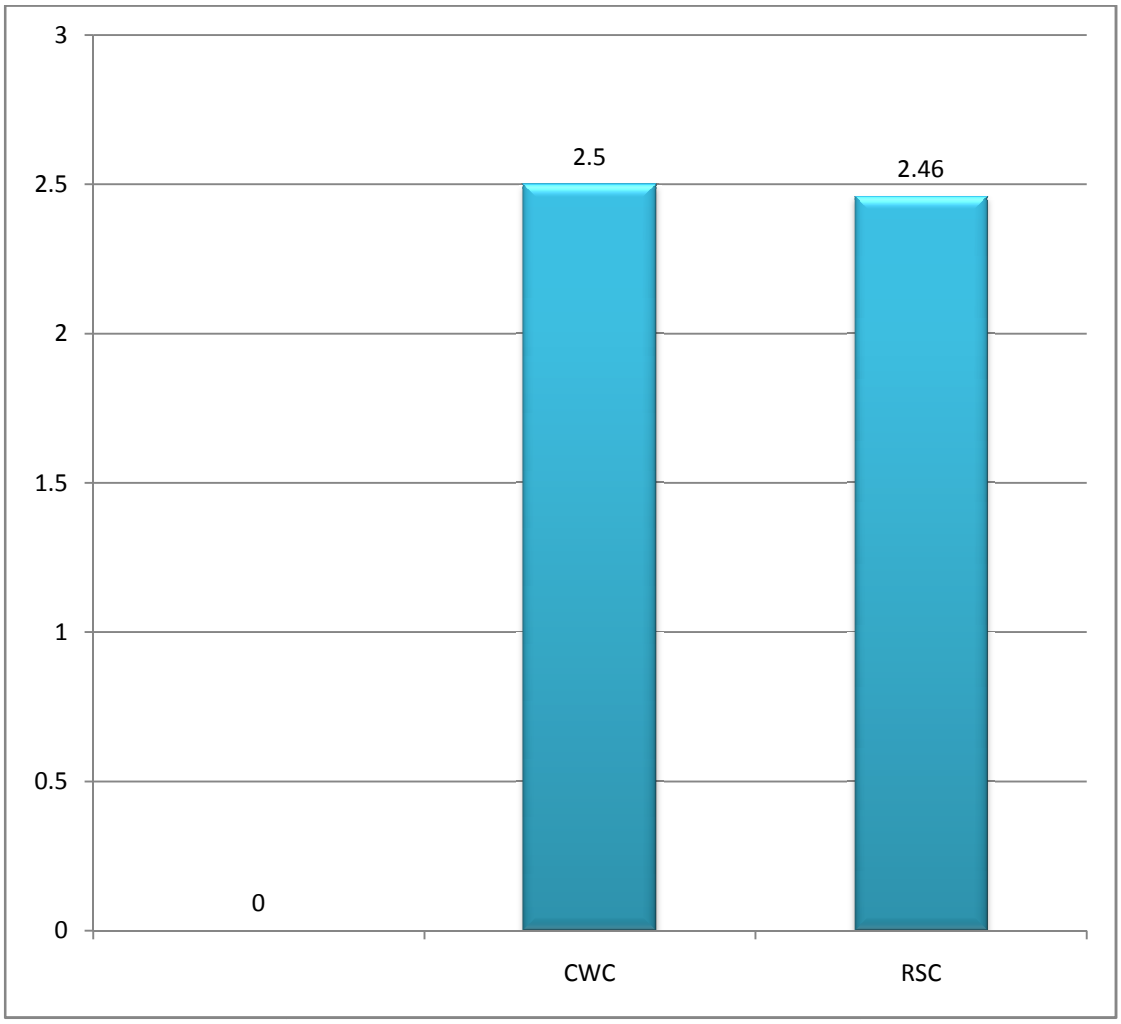


TABLE 5: DISTRIBUTION OF THE STUDY SUBJECTS ACCORDING TO AMERICAN SOCIETY OF ANAESTHESIOLOGIST (ASA) GRADING (N = 60)

ASA grading	CWC GROUP N(%)	RSC GROUP N(%)	Total N (%)
GRADE I	16 (53.3)	17 (56.7)	33
GRADE II	14 (46.7)	13 (43.3)	27
TOTAL	30 (100)	30 (100)	60 (100)

p value – 0.297

COMMENTS:

The difference in distribution of subjects in the groups according to ASA grading was not statistically significant and hence both the groups were comparable.

FIG 5: DISTRIBUTION OF THE STUDY SUBJECTS ACCORDING TO AMERICAN SOCIETY OF ANAESTHESIOLOGIST (ASA) GRADING (N = 60)

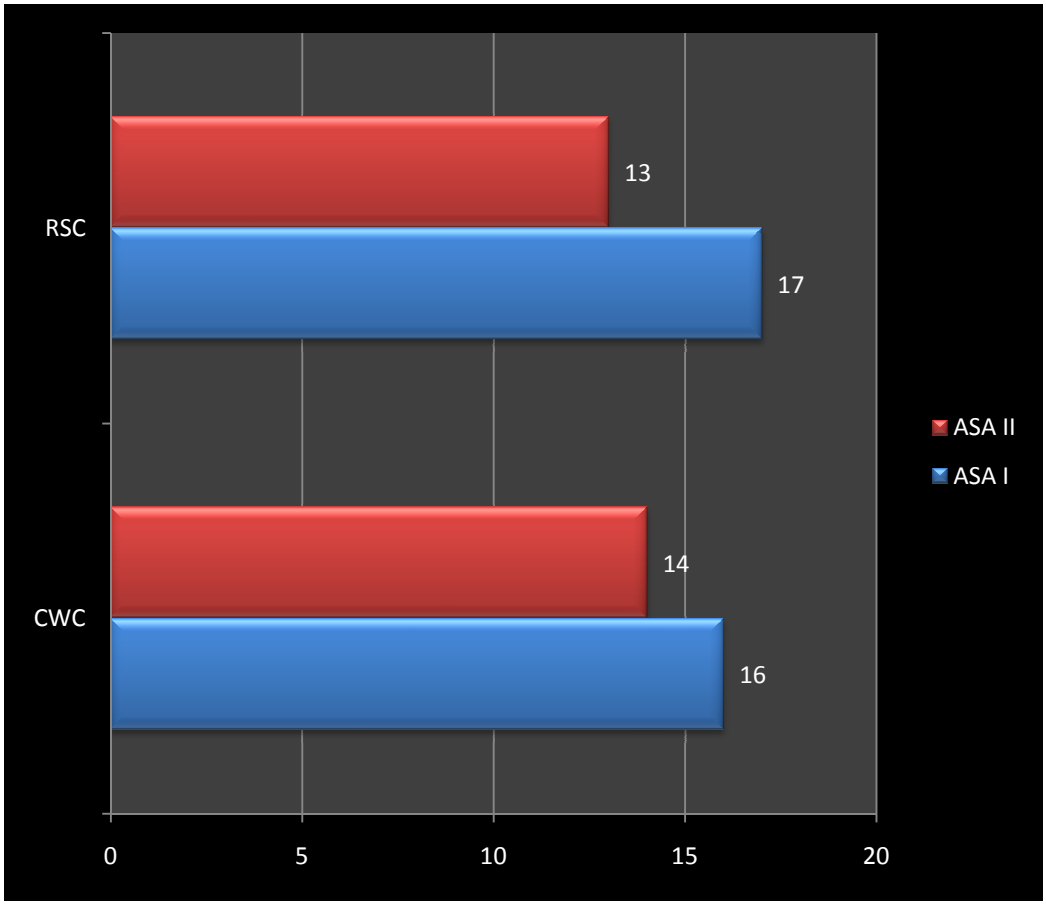


TABLE 6: COMPARISON OF HEART RATE IN THE POSTOPERATIVE PERIOD BETWEEN THE SUBJECTS IN TWO GROUPS (N = 60)

HEART RATE	GROUP	MEAN	STD. DEVIATION	p value
O HR	CWC	75.1	5.9	0.002
	RSC	69.8	6.27	
6 HR	CWC	79.3	4.8	0.001
	RSC	72.13	5.07	
12 HR	CWC	82.5	4.9	0.001
	RSC	74.53	4.2	
24 HR	CWC	85.5	4.5	0.001
	RSC	76.4	3.49	
36 HR	CWC	81.10	5.6	0.001
	RSC	72.3	5.9	
48 HR	CWC	75.6	4.6	0.001
	RSC	68.83	5.4	

COMMENTS

The mean change in heart rate in subjects who received local anaesthetic infusion through rectus sheath catheter was lower than the subjects with continuous wound catheter infusion and difference was statistically significant ($p<0.05$).

FIG 6: COMPARISON OF HEART RATE IN THE POST OPERATIVE PERIOD BETWEEN THE SUBJECTS IN TWO GROUPS (N = 60)

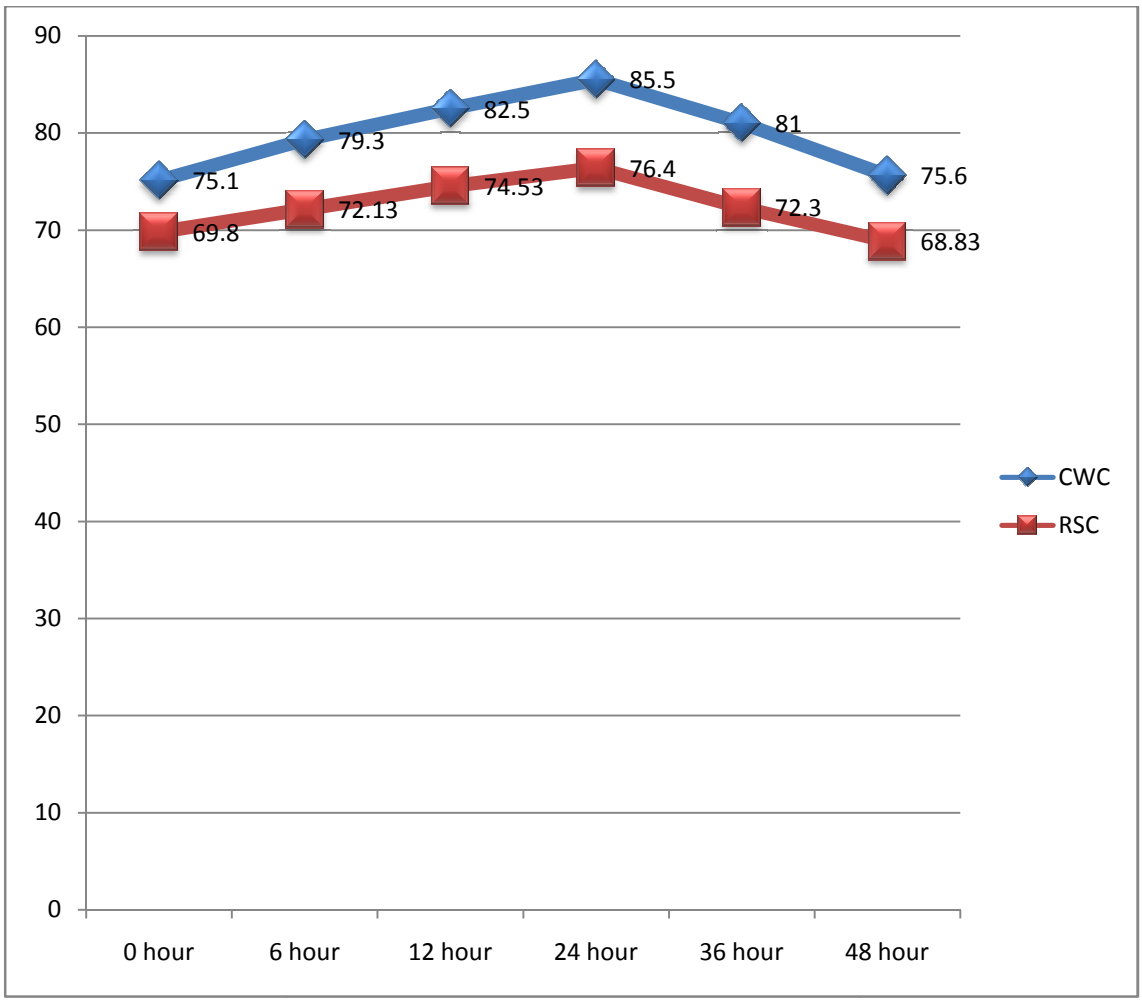


TABLE 7: COMPARISON OF POST OPERATIVE MEAN ARTERIAL PRESSURE AMONG THE SUBJECTS IN TWO GROUPS (N = 60)

MAP	GROUP	MEAN	STD. DEVIATION	p value
O HR	CWC	73.17	5.01	0.025
	RSC	70.03	5.6	
6 HR	CWC	77.10	5.3	0.001
	RSC	71.47	5.1	
12 HR	CWC	80.67	6.2	0.001
	RSC	75.1	5.2	
24 HR	CWC	82.43	5.78	0.001
	RSC	76.13	3.9	
36 HR	CWC	78.5	4.6	0.001
	RSC	70.53	5.78	
48 HR	CWC	73.83	5.3	0.001
	RSC	68.53	5.09	

COMMENTS

The mean change in MAP among the subjects in rectus sheath catheter infusion group is less compared with continuous wound catheter infusion group and the difference was statistically significant ($p<0.05$).

FIG 7: COMPARISON OF POST OPERATIVE MEAN ARTERIAL PRESSURE (MAP) AMONG THE SUBJECTS OF TWO GROUPS (N = 60)

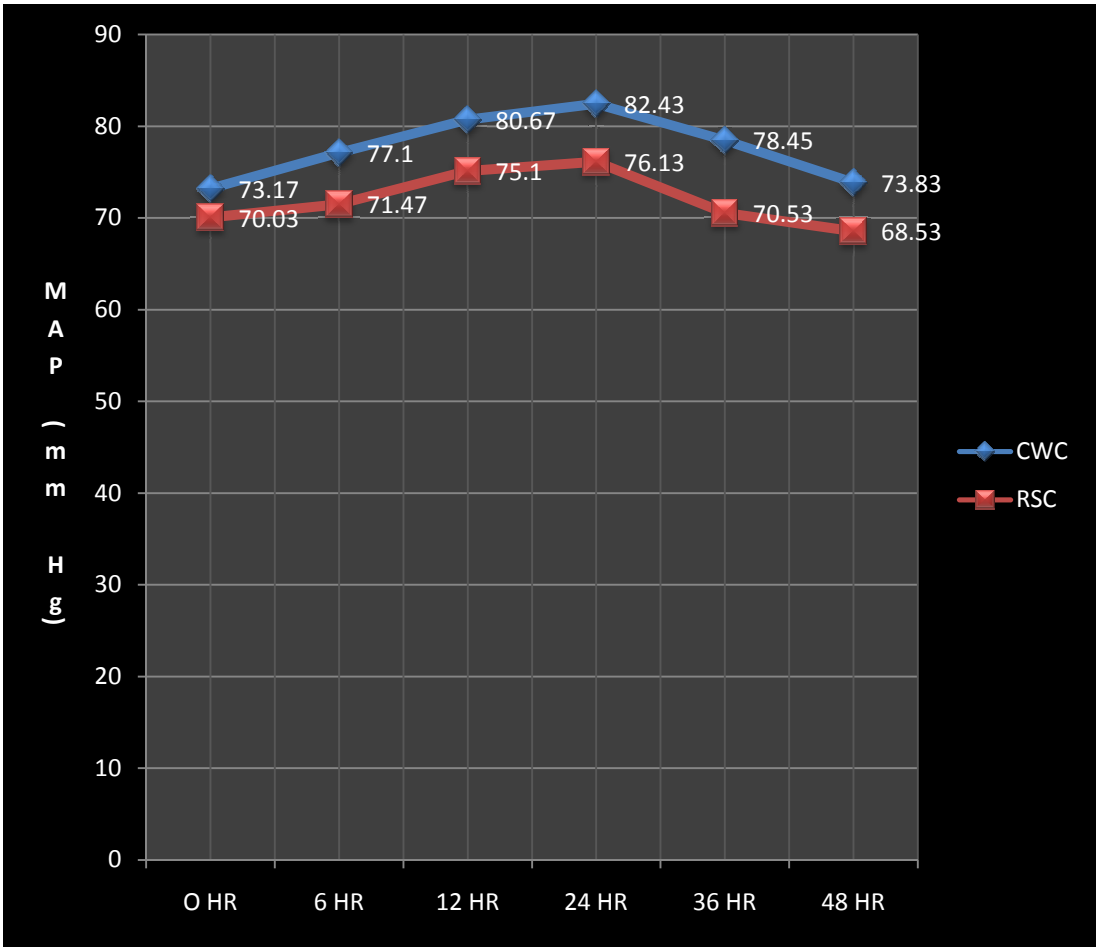


TABLE 8 : COMPARISON OF POST OPERATIVE VISUAL ANALOGUE SCALE (VAS) AT REST AMONG THE SUBJECTS IN TWO GROUPS (N = 60)

VAS	GROUP	MEAN	STD. DEVIATION	p value
0 HR	CWC	3.93	0.64	0.001
	RSC	2.20	0.99	
6 HR	CWC	3.86	0.59	0.001
	RSC	2.03	0.80	
12 HR	CWC	3.60	0.673	0.001
	RSC	1.67	0.97	
24 HR	CWC	3.97	0.556	0.001
	RSC	1.87	0.900	
36 HR	CWC	4.10	0.48	0.001
	RSC	1.70	1.17	
48 HR	CWC	3.8	0.55	0.001
	RSC	2.17	0.98	

COMMENTS

The VAS at rest among the rectus sheath catheter was significantly less than the continuous wound catheter infusion group and the results are statistically significant (p value<0.05)

FIG 8 : COMPARISON OF POST OPERATIVE VISUAL ANALOGUE SCALE (VAS) AT REST AMONG THE SUBJECTS IN TWO GROUPS (N = 60)

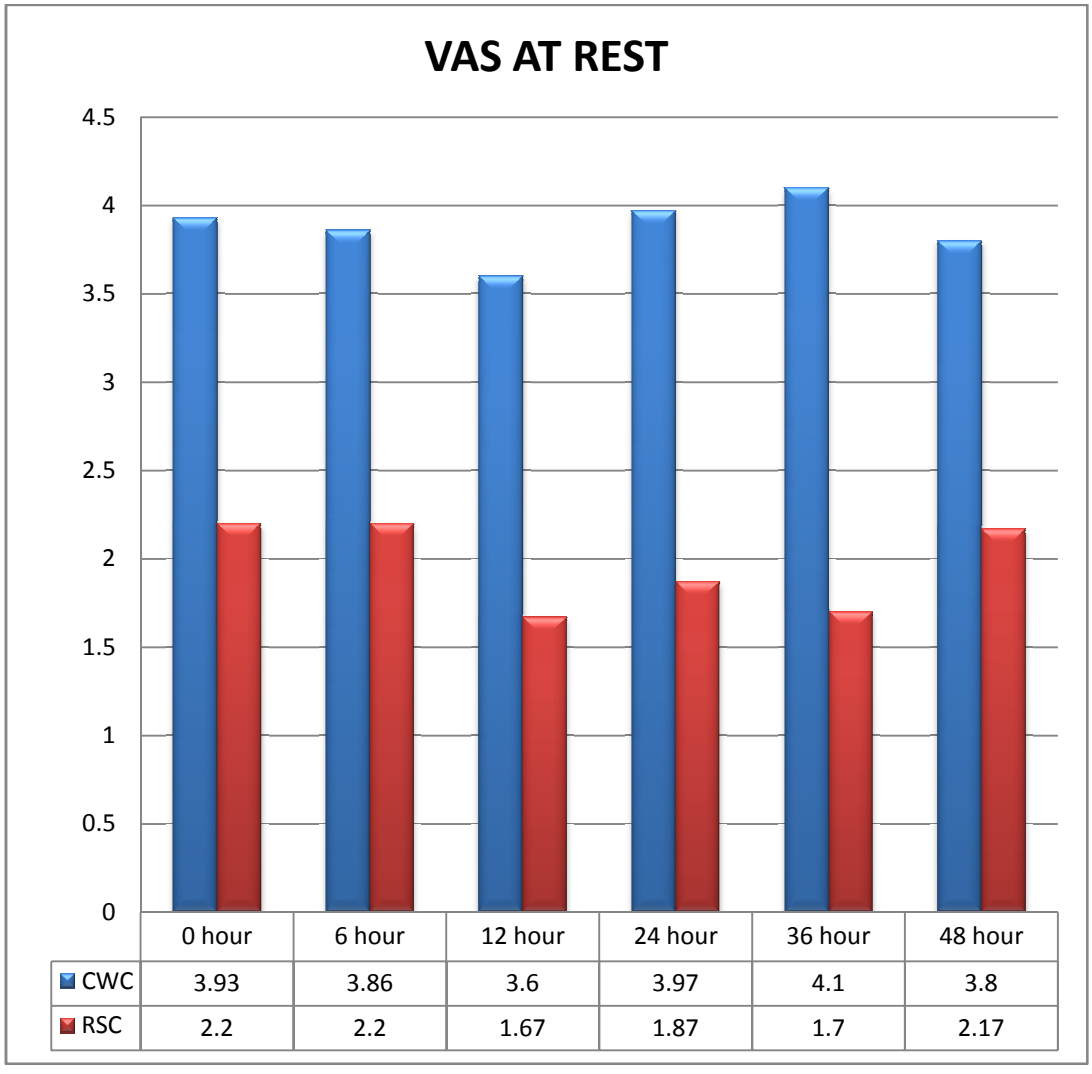


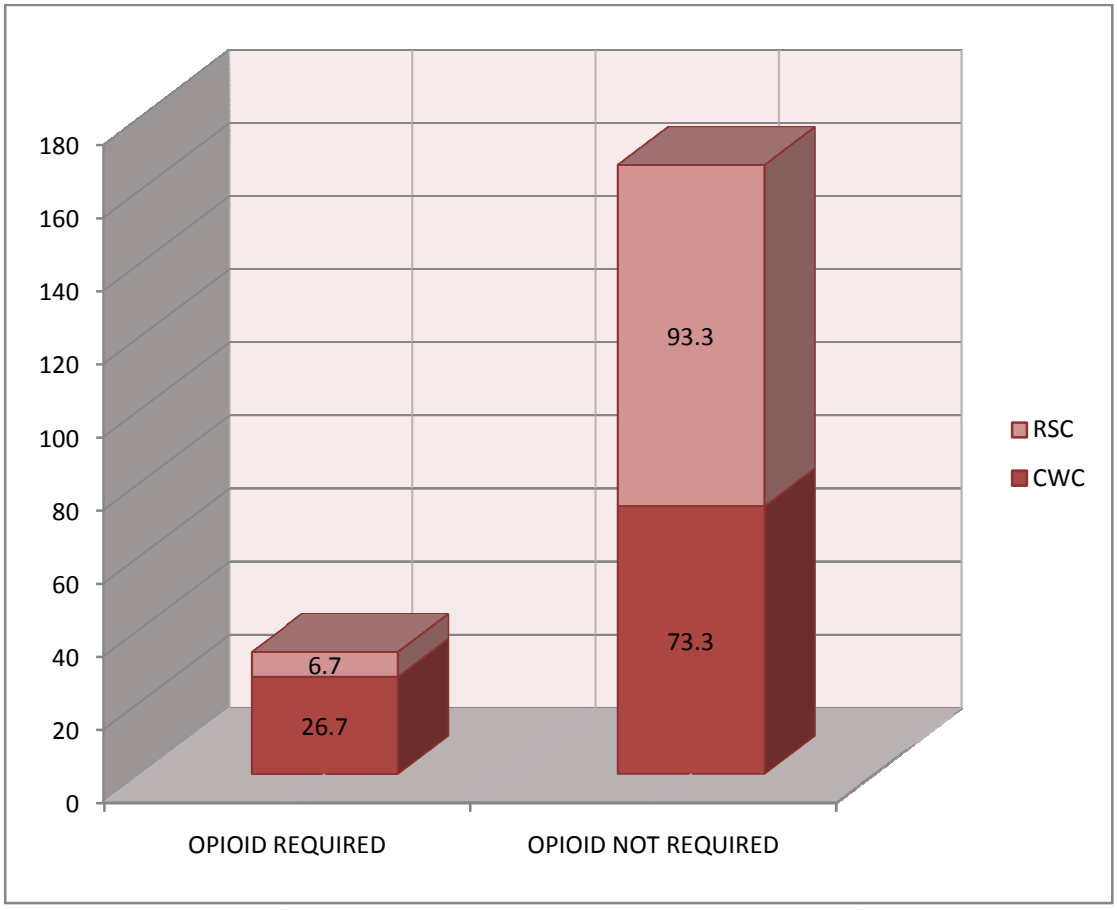
TABLE 9: COMPARISON OF POST OPERATIVE OPIOID REQUIREMENT IN SUBJECTS AMONG TWO GROUPS (N - 60)

GROUP	OPIOID REQUIRED N (%)	OPIOID NOT REQUIRED N (%)	TOTAL
CWC	8 (26.7)	22 (73.3)	30 (100)
RSC	2 (6.7)	28 (93.3)	30 (100)
p value	**0.001**		

COMMENTS:

Compared to the rectus sheath group, the subjects in continuous wound catheter infusion group required opioid in post-operative period and the results are statistically significant ($p<0.05$)

FIG 9 : COMPARISON OF POST OPERATIVE OPIOID REQUIREMENT IN SUBJECTS AMONG THE TWO GROUPS (N = 60)



DISCUSSION

Pain in post surgical patients leads to major complications in abdominal surgery. The traditional method of postoperative pain relief is the use of ‘on demand’ intramuscular opioid injection. Pain relief can be obtained with newer techniques like epidural opioids and patient controlled analgesia (PCA). Good postoperative analgesia decreases the magnitude of the neuro-endocrine stress, post operative pulmonary complications and myocardial ischemia. Early mobilisation can be achieved and bowel functions resume sooner. Four classes of drugs are used for pain relief in postoperative period.

1. Opioids
2. Paracetamol and NSAIDs
3. Local anaesthetics

When combination of these drugs are used in postoperative period, their effects appear to be synergistic. The American Pain Society has recommended 32 methods to provide postoperative analgesia in adults and children. In addition, Practice Guidelines for acute pain management in the Perioperative settings was developed by American Society of Anaesthesiologist Task Force. Regional anaesthesia techniques have been studied extensively for its efficacy and safety in providing postoperative analgesia. The Rectus sheath block although an older method is redefined by the advent of portable USG machines. The analgesic efficacy of the Rectus Sheath catheter was studied by scholars and their recommendations are given below.

Sanderman J. David et al studied the procedure for Ultrasound Guided Rectus Sheath block and catheter placement. In this study 13 – 6 MHz linear array probe was used to define the rectus sheath space and catheter was placed after dissection of space with distilled water. The Ultrasound guided technique resulted in higher block success rates, shorter onset time for blocked and the total dose of local anaesthetic required was less. The assessment of local anaesthetic spread was studied and reduced complication was reported. Needle insertion was directly visualised and hence plane of block was accurate.

Alsheed et al studied the case series of Ultrasound – guided rectus sheath block in children for umblical hernia repair. They studied 22 children from age group of 1.5 years to 8 years. Postoperative analgesic efficacy was evaluated using modified CHEOPS scale. There was no increase in hemodynamics recorded bot intraoperatively and postoperatively following an ultrasound guided rectus sheath block. None of the patient required additional fentanyl. Only one child scored >5 in modified CHEOPS Scale and supplemental analgesia was given with Inj. Morphine 0.1 mg / kg.

Mukesh Kumar Shah et al studied the analgesic efficacy of ultrasound-guided modified rectus sheath block compared with wound infiltration in reduction of postoperative morphine consumption in women undegoing open hysterectomy or myomectomy: A randomized controlled trial. 42 patients were studied and efficacy of both methods were compared using VAS score. This study concluded that Ultrasound – guided Modified Rectus Sheath Block does not show any significance change in morphine consumption in 24 hr

postoperative period as compared to Wound infiltration. Although the opioid consumption was significantly less in the first 24 hours postoperative period.

AR Godden et al studied the analgesic efficacy of Ultrasonography guided rectus sheath catheters versus epidural analgesia for open colorectal cancer surgery in a single centre. A 120 patients case records were reviewed retrospectively of which 85 patients had epidural analgesia and 24 had Rectus sheath Catheter. The study concluded that Epidural Analgesia was associated with higher incidence of hypotension than the Rectus sheath catheter group although the efficacy of pain relief was similar with both the groups. There was no change in other postoperative complications like respiratory tract infection, anastomotic leak and wound related complications.

Bashandy et al conducted a study on reducing Postoperative opioid consumption by adding an Ultrasound – guided Rectus Sheath block to multimodal analgesia for abdominal cancer surgery with midline incision. 60 patients were studied and all patients were given General anaesthesia. The VAS score was lower in Rectus sheath catheter group compared with General Anaesthesia group. The morphine consumption was lower in rectus sheath catheter group throughout 48 hours of postoperative period.

This study also shows the efficacy of Rectus sheath catheter in reducing the postoperative pain in patients undergoing abdominal surgery with midline incision. The results of the study is as follows

EFFICACY OF ANALGESIA AT VARIOUS TIME INTERVALS

In Rectus sheath catheter group, the mean VAS score was 2.2, 2.0, 1.67, 1.87, 1.7, 2.17 in 0 hr, 6 hr, 12 hr, 24 hr, 36 hr, 48hrpost operative period respectively. In Continuous Wound catheter group the mean VAS score was 3.93, 3.86, 3.6, 3.97, 4.10, 3.8 in the observation period. This shows that the Rectus sheath Catheter group had a better analgesia in postoperative period and p value was <0.05 in all the observation time period. Hence the difference between two groups is statistically significant.

OPIOID CONSUMPTION

In Rectus Sheath catheter group, opioid was required only in 6.7% patients compared with Continuous Wound catheter group in which 26.7% of patients required opioid. The opioid was required in 24 hour and 36 hour in postoperative period as the VAS score was >4. Only 2 patients in Rectus sheath catheter group required opioid in postoperative periods. 8 patients in Continuous Wound catheter required opioid in postoperative 24 hr and 36 hour period. This results concludes that opioid consumption was significantly less in rectus sheath catheter group.

POSTOPERATIVE HEART RATE

The mean postoperative HR in Rectus Sheath Catheter was 69, 72, 74, 76, 72, 68 at 0hr, 6 hr, 12 hr, 24 hr, 36 hr, 48 hr respectively. The postoperative HR in Continuous Wound catheter group was 75, 79, 82, 85,81, 75 at 0 hr, 6 hr, 12 hr, 24 hr, 36 hr, 48 hr respectively. This concludes that the mean HR was

significantly lower in Rectus Sheath catheter compared with Continuous Wound catheter group and the results were statistically significant with p value <0.05 in all the observational time period.

POSTOPERATIVE MEAN ARTERIAL PRESSURE

The mean postoperative MAP in Rectus Sheath catheter was 70, 71, 75, 76, 70, 68 at 0 hr, 6hr, 12 hr, 24 hr, 36 hr, 48hr respectively. The postoperative MAP in Continuous Wound catheter group was 73, 77, 80, 82, 78, 73 at 0 hr, 6hr, 12 hr, 24 hr, 36 hr, 48hr respectively. This concludes that MAP was significantly lower in Rectus Sheath catheter compared with Continuous Wound catheter group and the results were statistically significant with p value < 0.05 in all the observational time period.

SUMMARY

This randomized controlled study was done to evaluate the analgesic efficacy of Rectus sheath catheter infusion compared with Continuous Wound catheter infusion in patients undergoing abdominal surgery with midline laparotomy incision.

A total 60 patients belonging to ASA PS I and II were studied. They were divided into two groups. Group CWC received postoperative analgesia through continuous wound catheter infiltration with 0.25 % bupivacaine at rate of 2 ml / hr on each side. Group RSC received postoperative analgesia through Ultrasound Guided Rectus sheath catheter with 0.25% bupivacaine at rate of 2 ml / hr. The postoperative analgesic efficacy was measured using VAS score, opioid consumption and hemodynamic monitoring at different time intervals. Postoperative monitoring was done upto 48 hours.

The following observations were made

1. The study population were comparable in their age, sex and weight
2. There is no statistical difference in duration of surgery between two groups
3. The postoperative VAS score was less in Rectus sheath catheter group than the continuous wound catheter group
4. The postoperative opioid consumption in rectus catheter group was less compared with continuous wound catheter group.

5. The postoperative HR was high in all the observational time in continuous wound catheter group compared with rectus sheath catheter group
6. The postoperative MAP was high in all the observational time in continuous wound catheter group than in rectus sheath catheter group.

CONCLUSION

From the study conducted in postoperative patients, it is concluded that the analgesic efficacy of Rectus sheath catheter infusion is better than continuous wound catheter infusion and the postoperative opioid consumption can be decreased with Rectus sheath catheter infusion of Local Anaesthetics in Laparotomy surgeries.

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PROFORMA

DATE:

NAME AGE: SEX

DIAGNOSIS:

IP NO:

SURGICAL PROCEDURE DONE:

Ht: Wt: BMI

PRE OP ASSESSMENT:

HISTORY: Any Co-morbid illness

H/O previoussurgeries

GENERAL EXAMINATION:

HR BP SpO2

METs

SYSTEMIC EXAMINATION

CVS:

RS:

AIRWAY EXAMINATION

MMS- DENTITION TMD IID

INVESTIGATIONS

ASA PS CLASSIFICATION:

MEASURESOFSTUDYOUTCOME:

Premedication:

Induction:

Intubation:

Maintanence:

Catheter placed: Rectus sheath catheter/ wound catheter

COMPLICATIONSININTRAOPERATIVEPERIOD:

COMPLICATIONS POSTEXTUBATION:

DURATION OF SURGERY

HEMODYNAMICS: INTRAOPERATIVE

Events	Time	SystolicBP mmHg	DiastolicBP mmHg	MAP	Heartrate Beats/min	SPO2
Baseline						
Induction						
Incision						
End of Procedure						
Extubation						

HEMODYNAMICS: POST OPERATIVE

TIME (hrs)	0 hr			6 hr			12 hr			24 hr			36 hr			48 hr		
	HR	MAP	VAS	HR	MAP	VAS	HR	MAP	VAS	HR	MAP	VAS	HR	MAP	VAS	HR	MAP	VAS
C1																		
T1																		
C2																		
T2																		
C3																		
T3																		
C4																		
T4																		

INFORMATION TO PARTICIPANTS

Investigator **:** Dr.S. SAKTHI ABIRAMI

Name of the Participant:

Title:

Comparison of post-operative analgesic efficacy of rectus sheath catheter versus continuous wound infiltration for laparotomy surgery
(A Prospective, randomized, blinded study for evaluating the analgesic efficacy of continuous rectus sheath catheter infiltration vs continuous wound infiltration with Bupivacaine 0.25%)

You are invited to take part in this research study. We have got approval from the IEC. You are asked to participate because you satisfy the eligibility criteria. We want to compare and study the safety and post operative analgesic efficacy of continuous rectus sheath catheter infiltration vs continuous wound infiltration with Bupivacaine 0.25%)

What is the Purpose of the Research:

For laparotomysurgeries, efficacy of continuous rectus sheath catheter infiltration vs continuous wound infiltration with Bupivacaine 0.25%

A. To evaluate the post operative analgesic efficacy of continuous wound catheter infiltration vs continuous rectus sheath catheter infiltration

B. To evaluate Postoperative severity of pain using visualanalogue scale.

C. Post operative hemodynamics

D.Complicationrate

E. Post operativeopioidrequirement

The Study Design:

All the patients in the study will be divided into two groups.

Group CWC - Bilateral wound catheter

Group RSC - Bilateral rectus sheath catheter.

Benefits

Multi modal post operative analgesic technique to reduce post operative opioid consumption and its complications, with minimal side effects and superior pain relief without affecting hemodynamics.

Discomfortsandrisks

Intravascular local anaesthetic injection

Local anaesthetic toxicity

This intervention has been shown to be well tolerated as shown by previous studies. And if you do not want to participate you will have alternative standard treatment and your safety is our prime concern.

Time:

Date:

Place:

Signature/Thumb Impression of Patient

Patient Name:

Signature of the Investigator :

Name of the Investigator :

PATIENT CONSENT FORM

Study title "COMPARISON OF POST OPERATIVE ANALGESIC EFFICACY OF RECTUS SHEATH CATHETER VERSUS CONTINUOUS WOUND INFILTRATION FOR LAPAROTOMY SURGERY "(A Prospective, randomized study for evaluating the analgesic efficacy of rectus sheath catheter infiltration versus continuous wound infiltration with bupivacaine 0.25%)

Study center: INSTITUTE OF ANAESTHESIOLOGY AND CRITICAL CARE,
RAJIV GANDHI GOVT. GENERAL HOSPITAL,
MADRAS MEDICAL COLLEGE, CHENNAI-03

Participant name: Age: Sex: I.P.No:

I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask the question and all my questions and doubts have been answered to my satisfaction.

I have been explained about the procedure. I have been explained about the safety, advantage and disadvantage of the technique.

I understand that my participation in the study is voluntary and that I am free to withdraw at anytime without giving any reason.

I understand that investigator, regulatory authorities and the ethics committee will not need my permission to look at my health records both in respect to current study and any further research that may be conducted in relation to it, even if I withdraw from the study. I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from the study.

Time:

Date: Signature / thumb impression of patient

Place: Patient name:

Signature of the investigator:

Name of the investigator:

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI 600 003

EC Reg.No.ECR/270/Inst./TN/2013
Telephone No.044 25305301
Fax: 011 25363970

CERTIFICATE OF APPROVAL

To

Dr.S.Sakthi Abirami
I Year PG in MD Anaesthesiology
Institute of Anaesthesiology & Critical Care
Madras Medical College
Chennai 600 003

Dear Dr.S.Sakthi Abirami,

The Institutional Ethics Committee has considered your request and approved your study titled **"COMPARISON OF POST-OPERATIVE ANALGESIC EFFICACY OF RECTUS SHEATH CATHETER VERSUS CONTINUOUS WOUND INFILTRATION FOR LAPAROTOMY SURGERY " - NO.24052017**

The following members of Ethics Committee were present in the meeting hold on **02.05.2017** conducted at Madras Medical College, Chennai 3

1.Prof.Dr.C.Rajendran, MD.,	:Chairperson
2.Prof.R.Narayana Babu, MD.,DCH.,Dean, MMC,Ch-3	:Deputy Chairperson
3.Prof.Sudha Seshayyan,MD., Vice Principal,MMC,Ch-3	:Member Secretary
4.Prof.S.Suresh,MS.,Prof.of Surgery,MMC, Ch-3	: Member
5.Prof.S.Mayilvahanan,MD,Director,Inst. of Int.Med,MMC, Ch-3	: Member
6.Tmt.J.Rajalakshmi, JAO,MMC, Ch-3	: Lay Person
7.Thiru S.Govindasamy, BA.,BL,High Court,Chennai	: Lawyer
8.Tmt.Arnold Saulina, MA.,MSW.,	:Social Scientist

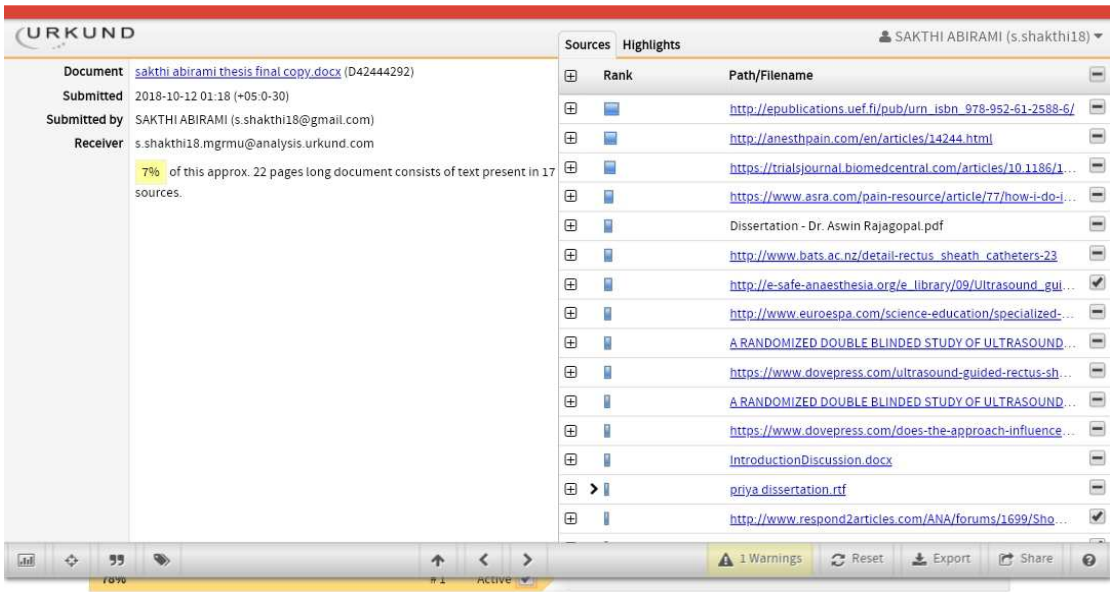
We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

Member Secretary – Ethics Committee

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003

ANTI - PLAGIARISM ANALYSIS



INTRODUCTION Effective analgesia is an integral part of postoperative management in surgical patients. Pain is limiting factor, such that it causes the following effects • Hemodynamic instablility • Decreased Functional Residual Capacity and increased work of breathing • Atlectasis and hypoxemia • Sepsis • ARDS • Poor wound healing and wound gaping • Opioid consumption and its adverse effects • Postoperative paralytic ileus • Poor healing of anastomosis site • Prolonged hospital stay • Increased morbidity The analgesic requirement of patients following laparotomy surgeries could not be met by single method. Multimodal analgesic methods were described, both intravenous and regional techniques. Each method has its own advantages and disadvantages, although all method aims to alleviate pain with minimal side effects. Off late, the use of intravenous opioids has been discouraged because of their potency to cause postoperative respiratory depression, sedation, postoperative nausea and vomiting. This limits the functional capacity of the patient and hence the wound healing is impaired. It also increases the morbidity of patient and prolongs the hospital stay. For the above mentioned shortcomigs, regional anaesthetic techniques were popularised. Epidural analgesia is the most widely used method of analgesia in intra – and postoperative period with a higher success rate. But in patients who are on anticoagulants or patients with anatomical spine distortion the use of epidural catheter to provide continuous analgesia is either impossible or contraindicated. Hence anaesthesia is provided by regional blocks of nerves innervating the incision site in abdominal surgeries. Modified Rectus Sheath Block is in practice since 19th century. With the advent of portable UltraSonogram machine this regional anaesthetic technique has been revolutionised. The USG provides image to localise the nerve bundles precisely, and thus avoiding the complication of like intravascular injection, local anaesthetic toxicity, damage to nerve bundles and also increases the success rate of blockade. USG guided rectus sheath block can be a single shot injection of local anaesthetic into posterior rectus sheath but the duration of analgesia is limited. Hence a modified rectus sheath block with catheter placement in the posterior rectus sheath allows continuous infusion of local anaesthetic in the post operative period.

AIMS AND OBJECTIVES • To compare the post operative analgesic efficacy of continuous rectus sheath catheter infiltration and continuous wound catheter infiltration • To evaluate the severity of pain using visual analogue scale • To evaluate the post operative opioid requirement • To assess post operative hemodynamics • Complication rate

PHYSIOLOGY OF PAIN •

Pain is a complex phenomenon includes sensory and motivational components. • The sensory component depends on

spino thalamic tracts to cerebral cortex • The motivational component include attention, somatic reflexes, autonomic reflexes and emotional change • Nociception has 4 components 1. Transduction 2. Transmission 3. Modulation 4. Perception NOCICEPTORS (PAIN RECEPTORS) Primary afferents responds to noxious stimuli in skin, joints, muscles, vasculature and viscera. It responds to multiple energy source that might produce potential inury (mechanical, thermal and chemical stimuli) and relay the information to CNS. C- fibre afferents – unmyelinated, conduction velocity >2m/sec. Signals burning pain from intense heat stimuli and sustained pressure A- Fibre afferents – myelinated, conduction velocity <2m/sec. Type I – A beta - high threshold mechano receptors Type II – A delta - heat stimuli, no response to mechanical stimuli

DORSAL HORN: THE RELAY CENTER FOR NOCICEPTION Afferent fibres from nociceptors enter spinal cord in dorsal root and synapse with dorsal

URKUND

Urkund Analysis Result

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Submitted: 10/11/2018 9:48:00 PM
Submitted By: s.shakthi18@gmail.com
Significance: 7 %

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Instances where selected sources appear:

32

ANTI – PLAGIARISM CERTIFICATE

This is to certify that this dissertation work titled **"COMPARISON OF POST-OPERATIVE ANALGESIC EFFICACY OF RECTUS SHEATH CATHETER VERSUS CONTINUOUS WOUND INFILTRATION FOR LAPROTOMY SURGERY"** of the candidate **Dr. S. SAKTHI ABIRAMI** with registration number **201620015** the award of **M.D**. in the **ANAESTHESIOLOGY**. I personally verified the urkund.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains from introduction to conclusion pages and result shows **7 %** of plagiarism in the dissertation.

Guide & Supervisor signature

ABBREVIATIONS

CWC	–	Continuous Wound Catheter
RSC	–	Rectus sheath catheter
ACC	–	Anterior Cingulate Cortex
ACLS	–	Advanced Cardiac Life Support
ARDS	–	Adult Respiratory Distress Syndrome
ASA PS	–	American Society of Anaesthesiologists Physical Status
DBP	–	Diastolic Blood Pressure
GABA	–	Gamma Amino Benzoic Acid
HR	–	Heart Rate
IC	–	Internal Capsule
LA	–	Local Anaesthetics
LAST	–	Local Anaesthesia Systemic Toxicity
MAP	–	Mean Arterial Pressure
NSAIDs	–	Non – Steroidal Anti – inflammatory drugs
PAG – RVM	–	Peri Aqueductal Grey Matter – Rostro Ventral Medulla
PZT	–	Lead ZirconateTitanate
SBP	–	Systolic Blood Pressure
SVR	–	Systemic Vascular Resistance
STT	–	Spino Thalamic Tract
USG	–	Ultra Sonogram
VAS	–	Visual Analog Scale

MASTER CHART

GROUP CWC	AGE	SEX	WT	ASAPS	DURATION
C1	48	M	72	II	2.05
C2	52	F	56	II	1.52
C3	32	F	52	I	2.3
C4	55	F	65	I	2.45
C5	38	F	65	II	1.56
C6	38	F	52	I	2.58
C7	39	M	69	II	2.17
C8	27	M	71	I	2.26
C9	28	F	52	I	2.18
C10	50	M	65	I	1.56
C11	56	F	51	II	2.42
C12	40	F	63	I	2.35
C13	47	M	70	I	2.48
C14	48	M	69	II	2.5
C15	52	F	52	II	3.1
C16	45	M	75	I	3.5
C17	48	M	69	I	2.5
C18	58	F	62	II	3.1
C19	48	M	71	I	3.1
C20	42	F	60	I	2.45
C21	49	M	69	II	2.5
C22	42	F	59	II	3.5
C23	41	M	75	I	3.3
C24	38	F	59	I	2.46
C25	30	M	65	I	1.58
C26	52	M	69	II	2.1
C27	35	F	60	I	2.3
C28	48	F	58	II	2.4
C29	52	M	72	II	3.3
C30	55	F	62	II	3.5

0 HR			6 HR			12 HR			24 HR		
HR	**MAP**	**VAS**	**HR**	**MAP**	**VAS**	**HR**	**MAP**	**VAS**	**HR**	**MAP**	**VAS**
67	72	4	70	80	3	70	88	3	70	90	4
72	76	4	74	82	3	78	87	3	82	86	3
65	70	4	78	86	5	88	90	4	90	89	4
64	69	5	77	76	4	86	88	3	89	87	4
76	80	3	82	86	4	82	89	4	87	90	4
82	72	4	85	78	3	88	82	4	89	86	4
80	79	5	80	72	4	82	86	4	84	88	4
76	74	4	79	84	4	82	86	3	87	89	4
74	72	5	78	82	4	80	84	6	86	86	6
69	76	3	74	78	4	84	80	4	90	82	4
72	77	4	76	80	4	82	82	3	88	86	4
76	64	4	79	69	4	88	72	4	89	76	4
74	62	4	82	68	3	86	70	3	88	74	3
78	80	4	85	82	4	89	89	3	90	88	4
82	69	5	85	72	4	86	75	4	88	72	4
85	72	4	86	75	4	89	78	4	89	79	4
80	70	4	82	78	5	83	85	4	85	89	4
65	78	4	69	80	5	74	85	4	80	79	4
68	70	4	72	72	4	78	75	4	80	78	4
72	72	3	75	75	3	79	73	3	82	78	4
80	69	4	82	70	4	85	72	4	88	74	5
81	82	3	85	83	4	83	85	4	89	85	4
69	66	4	75	69	4	72	72	3	78	74	4
75	75	5	79	78	4	80	79	4	85	78	4
72	72	4	78	73	4	82	75	3	85	79	4
78	78	3	80	80	3	82	79	3	84	84	4
75	80	3	79	82	4	78	85	3	80	89	3
82	69	4	85	70	4	87	73	4	88	75	4

79	72	3	80	73	3	83	75	3	85	78	3
85	78	4	88	80	4	89	81	3	90	85	4

36 HR			**48 HR**			**OPIOID CONSUMPTION**
HR	**MAP**	**VAS**	**HR**	**MAP**	**VAS**	
68	76	4	64	72	3	N
72	82	4	68	80	4	N
74	86	4	69	79	5	Y
76	82	4	74	74	4	N
74	86	4	69	82	4	N
76	74	4	79	72	5	Y
89	76	4	79	62	3	N
74	79	4	76	76	3	N
76	79	5	72	74	3	Y
84	79	4	72	76	4	N
79	74	4	74	68	3	N
84	74	4	72	67	4	N
76	76	4	76	66	4	N
82	85	4	80	82	4	N
82	74	4	78	70	3	N
86	80	4	82	75	4	N
82	85	5	80	78	4	Y
80	82	5	72	75	4	Y
82	73	5	75	69	4	Y
80	78	4	72	71	4	N
89	72	4	80	68	4	Y
89	83	4	82	83	4	N
80	70	4	75	68	4	N
86	79	5	79	76	4	Y
80	76	4	75	73	4	N
85	82	4	78	78	3	N

82	86	3	75	80	4		N
89	73	4	80	69	4		N
85	75	3	80	74	3		N
89	79	4	82	78	4		N

GROUP	RSC	AGE	SEX	WEIGHT	ASA	DURATION
	T1	32	M	78	II	2.28
	T2	46	M	65	I	2.42
	T3	52	F	61	II	3.1
	T4	49	M	79	II	2.45
	T5	45	F	72	I	2.06
	T6	35	F	70	I	1.5
	T7	29	M	81	I	2.3
	T8	38	F	72	II	2.22
	T9	46	F	65	II	2.24
	T10	38	M	81	II	2.3
	T11	41	M	82	I	1.4
	T12	28	M	75	I	2.4
	T13	44	F	72	I	2.5
	T14	34	F	69	II	3.5
	T15	39	M	78	I	3.2
	T16	51	F	60	II	3.25
	T17	48	M	71	II	3.1
	T18	45	F	59	I	2.2
	T19	52	F	58	II	2.1
	T20	52	M	69	II	2.5
	T21	48	F	58	II	3.1
	T22	45	M	75	I	1.5
	T23	35	F	58	I	1.3
	T24	28	M	65	II	2.15
	T25	52	F	60	I	2.55

T26	35	M	75	I	3.15	
T27	46	F	60	I	3.3	
T28	32	M	69	I	2.3	
T29	41	F	55	I	2.5	
T30	41	M	70	I	3.1	

0 HOUR			**6 HOUR**			**12 HOUR**			**24HOUR**		
HR	**MAP**	**VAS**	**HR**	**MAP**	**VAS**	**HR**	**MAP**	**VAS**	**HR**	**MAP**	**VAS**
66	62	3	68	64	3	72	68	2	76	70	3
64	67	3	67	68	4	70	69	3	74	72	2
68	66	4	69	68	3	72	70	4	78	76	4
60	64	3	62	68	3	70	70	4	72	72	3
61	79	3	64	80	3	69	80	2	70	79	2
62	74	2	66	76	3	68	78	2	72	80	2
60	62	3	68	64	2	69	66	2	76	68	2
61	68	4	64	69	2	68	69	2	74	72	3
78	80	2	79	79	2	80	79	1	80	80	1
72	74	4	76	72	3	78	76	3	82	74	2
76	76	3	78	78	2	74	79	2	80	80	4
79	74	2	80	76	2	81	78	1	80	80	2
74	72	1	76	74	1	78	76	1	79	80	2
76	74	2	74	72	2	78	76	2	80	80	1
68	64	2	72	68	3	74	70	2	76	72	2
62	72	3	70	74	2	72	76	2	74	78	2
80	74	2	78	76	2	79	78	2	80	80	1
78	76	1	74	77	1	80	78	2	80	80	1
72	78	2	74	79	1	78	80	2	80	80	2
65	62	2	68	65	2	72	66	2	75	75	1
62	68	2	65	70	1	66	72	1	68	68	1
75	72	1	76	73	0	78	75	0	78	78	1
73	75	0	75	78	2	76	79	1	77	77	2
68	68	1	70	70	2	75	72	1	73	73	1

72	65	2	75	66	2	78	68	4	79	79	2
72	62	3	75	63	2	78	64	2	79	79	2
75	72	2	78	73	2	79	74	1	78	78	1
70	71	1	72	72	2	73	73	1	75	75	2
72	68	2	73	69	1	75	70	1	72	72	2
75	62	1	78	63	1	76	64	1	77	77	0

36 HOUR			**48 HOUR**			**OPIOID CONSUMPTION**
HR	**MAP**	**VAS**	**HR**	**MAP**	**VAS**	
68	60	2	62	62	3	N
66	70	2	64	68	3	N
70	68	5	69	66	4	Y
68	58	3	60	59	4	N
59	72	2	58	74	3	N
60	62	3	61	64	3	N
60	58	2	58	58	3	N
68	64	2	64	62	2	N
74	76	1	70	74	2	N
78	72	2	74	70	4	N
76	74	5	76	72	2	Y
74	74	3	72	72	3	N
72	76	2	70	74	1	N
74	74	1	71	72	2	N
71	72	1	70	70	1	N
66	74	1	64	72	2	N
79	72	1	74	70	2	N
72	78	1	70	74	2	N
76	76	1	70	72	2	N
78	65	2	69	63	2	N
69	72	1	63	67	2	N
78	75	1	76	73	0	N
72	79	2	75	78	1	N

78	73	0	68	70	1	N
79	68	1	75	65	2	N
79	66	1	75	63	3	N
78	75	1	75	73	2	N
72	75	1	70	72	1	N
78	72	1	72	70	2	N
78	66	0	70	63	1	N